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REPORT #
RRTAC 93-10

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Proceedings of the Alberta Wellsite Reclamation Criteria Workshop

Heritage Fund

Alberta
CONSERVATION AND
RECLAMATION COUNCIL
Reclamation Research
Technical Advisory Committee

Alberta's Reclamation Research Program

Regulating surface disturbances in Alberta is the responsibility of the Conservation and Reclamation Council. The Council Chairman is from Alberta Environmental Protection. The Council oversees a reclamation research program, established in 1978, to identify the most efficient methods for achieving acceptable reclamation in the province. Funding for the research program is provided by Alberta's Heritage Savings Trust Fund, Land Reclamation Program.

To assist with the development and administration of the research program, the Council appointed the inter-departmental Reclamation Research Technical Advisory Committee (RRTAC). Committee members represent the Alberta Departments of Agriculture, Food and Rural Development, Energy, and Environmental Protection, and the Alberta Research Council. The Committee updates research priorities, reviews research proposals, organizes workshops, and otherwise acts as the coordinating body for reclamation research in Alberta.

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REPORT #
RRTAC 93-10

Proceedings of the
Alberta Wellsite Reclamation
Criteria Workshop

by

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Prepared for

Canadian Association of Petroleum Producers

and

Oil and Gas Reclamation Research Program

ALBERTA CONSERVATION AND RECLAMATION COUNCIL
(Reclamation Research Technical Advisory Committee)

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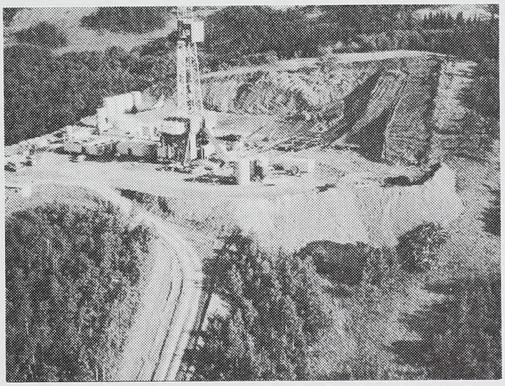

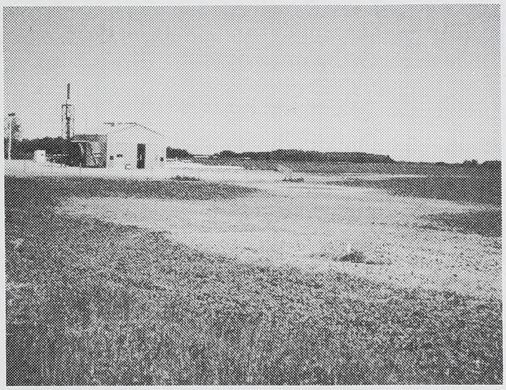

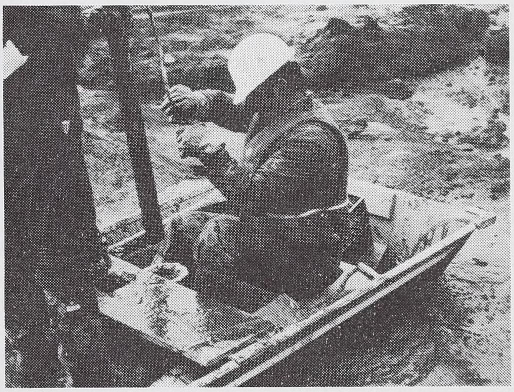

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DISCLAIMER

This report is intended to provide government and industry staff with up-to-date technical information to assist in the preparation and review of Conservation and Reclamation Approvals, and development of guidelines and operating procedures. This report is also available to the public so that interested individuals similarly have access to the most current information on land reclamation topics.

The opinions, findings, conclusions, and recommendations expressed in this report are those of the authors and do not necessarily reflect the views of government or industry. **Specifically, the comments obtained from workshop participants and from people who submitted responses prior to the workshop are their own and do not necessarily reflect government or industry views.** Mention of trade names or commercial products does not constitute endorsement, or recommendation for use, by government or industry.

REVIEWS

This report was reviewed by Rob Staniland, Talisman Energy Inc. and Chris Powter, Chairman, RRTAC.

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GLOSSARY OF TERMS

The following terms are used in these proceedings.

Assessment	A judgement of the value or worth of something, either tangible or intangible.
Control Section	The vertical section of the soil upon which classification or evaluation is based. The depth will vary depending on the purpose or system being used.
D & R Plans	Refers to Development and Reclamation Plans.
Equivalent Land Capability	A situation where the ability of the land to support various land uses after reclamation is similar to the ability that existed prior to an activity being conducted on the land. The ability to support individual land uses will not necessarily be identical after reclamation.
Green Area	Refers to those public land areas of the Province of Alberta for which the Department of Environmental Protection-Forest Services Division is responsible for management. These areas are predominantly unsettled, forested (uncultivated) areas of the province.
Land	For the purposes of the definitions of land capability and equivalent land capability – land includes terrestrial, semi-aquatic, and aquatic landscapes.
Land Capability	The ability of the land to support a given land use on a sustained basis irrespective of future management inputs, activities or alterations. It refers to an evaluation or rating of the kind and degree of limitations on land use, in terms of physical, chemical and biological characteristics, such as topography, drainage, hydrology, soils and vegetation. It includes any existing abilities and conditions which are the result of previous alterations or management practices.
Measurement	Determining the magnitude, extent or degree of something.
Reclamation	The process of returning disturbed land to a useful and productive condition. Reclamation of oil and gas wellsites is regulated under the Alberta Environmental Protection and Enhancement Act and the Conservation and Reclamation Regulation.
Salinity	A measure of the amount of soluble salts in a soil.
Soil Horizon	Layers in a typical mineral soil profile are often referred to as horizons. The major horizons are labelled A, B, and C, and there may be further subdivisions of these layers. The A horizon is found at the soil surface, contains the most organic matter, and is considered to be the layer with the best characteristics for plant growth. The A horizon is often called the topsoil. The B horizon occurs below the A horizon and is usually intermediate in quality between A and C horizons. The C horizon is most similar to the underlying parent material and is, in some cases, composed of materials that are not suitable for plant growth.

GLOSSARY OF TERMS (concluded)

Soil Profile	Consists of a vertical section of a soil, usually through all its horizons and extending into the parent material.
Wellsite	The land (including access) over which an oil or gas drilling/production facility is constructed and operated. Through a legal instrument known as a surface lease, the company is granted the right to install and operate the oil-gas facilities on the wellsite. Reclamation criteria cover the wellsite plus associated facilities such as borrow pits, campsites, off-site sumps or other off-site disturbances tied to the well development.
Wellsite Construction	Standard wellsite construction including: surveying, clearing, access, development, topsoil-handling, grading, clean-up and reclamation.
White Area	Refers to those public land areas of the Province of Alberta for which the Department of Agriculture, Food and Rural Development-Public Lands Division is responsible for management. These areas are predominantly settled, agricultural (cultivated and uncultivated) areas of the province.

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Communiplan Inc. would like to express appreciation to those who provided assistance, information and commentary to these *Alberta Wellsite Reclamation Criteria Proceedings*. Special thanks are extended to Mr. Chris Powter of Alberta Environmental Protection for his informed guidance, support and project management efforts and to Mr. Rob Staniland of Talisman Energy for his coordination of industry's response and participation in the workshop. Government funding was provided by the Reclamation Research Technical Advisory Committee through the Alberta Heritage Savings Trust Fund, Land Reclamation Program. Industry funding was provided by the Canadian Association of Petroleum Producers.

We are also appreciative of the efforts of Mr. Len Knapik and Mr. Tim Bossenberry of Pedocan Land Evaluation who provided technical direction in the compilation of these proceedings and, with Mr. Gary Mott of G.C. Mott Associates, acted as co-facilitators at the workshop. Thanks also to Ms. Dorinda Wong and Ms. Carol Bechdholt, for their patience and accuracy in recording and transcribing these important workshop proceedings.

We believe that much of the real success of any workshop hinges on the break-out discussions and plenary group sessions. These sessions provided an open forum for all participants to engage in dialogue and discussion of important wellsite reclamation criteria issues. Thanks to all participants.

While these proceedings could not have been produced without the assistance and contributions of the aforementioned, Communiplan Inc. accepts full responsibility for any errors or omissions.

EXECUTIVE SUMMARY

An industry/government/stakeholder workshop to discuss the draft *Reclamation Criteria for Wellsites and Associated Facilities* to be used to determine wellsite reclamation success (a process which will become integral to the granting of a Reclamation Certificate) was held on January 19 and 20, 1994. The workshop was intended to further consultative efforts on the identification and application of reclamation standards on important soil, vegetation and landscape parameters.

The workshop was a combined industry and government undertaking. Government, through the Reclamation Research Technical Advisory Committee (RRTAC), engaged the services of Communiplan Inc. of Edmonton to help with the facilitation of the workshop and preparation of these proceedings. Technical assistance was also provided by Pedocan Land Evaluation Ltd. of Edmonton and G.C. Mott Associates of Calgary.

The workshop consisted of introductory statements by government and industry, an overview of the wellsite reclamation criteria consultative process to date, a series of "break-out" work group sessions, and plenary sessions.

Each of the workshop participants was assigned membership in one of four technical break-out groups or a fifth group, to discuss policy and issue-related concerns. The main workshop task was to discuss each element of the criteria and suggest whether: no changes were required, minor changes were required, major changes were required, the criterion should be deleted, or another parameter should be substituted. On the first day of the workshop, the groups discussed the soil-related criteria. This exercise helped to identify where significant changes to the soils-based criteria were thought to be required. On the second day of the workshop, vegetation and landscape-related criteria were discussed. The workshop concluded with an afternoon plenary session, where the group facilitators presented the group findings followed by an open discussion period.

The workshop provided an important and active forum for the discussion of the draft *Reclamation Criteria for Wellsites and Associated Facilities*. In concert with the pre-workshop submission of comment sheet reviews, letters and memoranda, and suggestions at the workshop, it was decided that an Industry/Government Wellsite Reclamation Criteria Committee be struck to further examine the collected and tabulated information and recommendations, and finalize the wellsite criteria document in early 1994.

1. INTRODUCTION

A government/industry/stakeholder workshop to review and discuss the draft *Reclamation Criteria for Wellsites and Associated Facilities* was held on January 19 and 20, 1994. The workshop was intended to provide technical discussion and input into the draft criteria on the basis of experience gained during the 1994 field season. The criteria are being jointly developed by representatives of the Canadian Association of Petroleum Producers (CAPP), the Alberta Government's Department of Environmental Protection and the Department of Agriculture, Food and Rural Development. External stakeholders have also been encouraged to participate in the consultative process.

The planning, development and implementation of the workshop was a combined government/ industry undertaking. Government provided extensive pre-workshop support and engaged the services of Communiplan Inc. of Edmonton, to help with the workshop facilitation and preparation of these proceedings. Communiplan in turn sought the technical services of Pedocan Land Evaluation of Edmonton and G.C. Mott Associates of Calgary.

Industry, both individually and through CAPP, provided pre-workshop support, sponsored the plenary and break-out room costs and all refreshment/luncheon arrangements.

The following section introduces the reader to the terms of reference for the workshop and the workshop agenda.

1.1 RECLAMATION CRITERIA FOR WELLSITES AND ASSOCIATED FACILITIES

The initial *Reclamation Criteria for Wellsites and Associated Facilities* package was developed in 1992-93 by the Alberta Land Conservation and Reclamation Council based on its 30 years of experience in wellsite certification. The proposed criteria package was reviewed by industry representatives and other major stakeholders in early 1993. Changes to the proposed criteria were made as a result of these meetings and a four-part reclamation criteria package was issued to wellsite construction representatives and operators. The draft criteria package included the following items (attached to these proceedings as Appendices A, B, C and D, respectively):

- Information Letter: Reclamation Criteria for Wellsites and Associated Facilities
- Conservation and Reclamation Code of Practice for Alberta
- Reclamation Criteria for Wellsites and Associated Facilities
- Wellsite Reclamation Certificate Application

The fundamental principle of the criteria is that any changes caused by project activities should be measured against the original or representative off-site adjacent conditions. The certification criteria describe the allowable changes in site conditions (landscape, soil and vegetation) that will still maintain equivalent land capability. The criteria apply to wellsite leases, access roads, and off-site borrow pits, sumps and campsites.

Level I criteria will be used to judge reclamation success and grant the reclamation certificate. The operator must supply information relative to the criteria on the Wellsite Reclamation Certificate Application form. In Level I, field assessments are used. Level II is used to help identify and characterize problem areas that require further reclamation prior to application for certification.

The draft criteria were applied as a test for the 1993 field season. The results of the trial period were to be reviewed with stakeholders prior to the establishment of the final set of criteria in 1994. The Wellsite Reclamation Criteria Workshop was intended to provide a forum for stakeholder discussion.

1.2 ALBERTA WELLSITE RECLAMATION CRITERIA WORKSHOP

The Conservation and Reclamation Council was concerned that proper stakeholder consultation be completed on the draft *Reclamation Criteria for Wellsites and Associated Facilities*. It was suggested in mid-1993 that a workshop be held prior to the commencement of the 1994 field season to further discuss the draft criteria on the basis of the results of the 1993 field season.

1.2.1 Terms of Reference

The Alberta Wellsite Reclamation Criteria Workshop was convened to determine the problems or concerns that government and industry had encountered in using the draft criteria package during the 1993 field season. Specifically, workshop participants were to examine soils, landscape and vegetation criteria. If time would permit, remaining issues such as the application form and other implementation issues would be discussed. For each of the identified criteria, the workshop participants were asked to consider whether: no changes were required, minor changes were required, major changes were required, the criterion should be deleted, or another parameter should be substituted.

The workshop also provided an opportunity to discuss some of the comment sheet reviews, letters and memoranda which were submitted in response to the field-testing of the draft criteria during 1993.

1.2.2 Workshop Proceedings and Agenda

These *Alberta Wellsite Reclamation Criteria Proceedings* have been, wherever possible, arranged in chronological order. The workshop opening remarks, objectives and government/industry perspectives on the draft reclamation criteria are noted in Section 2. Several keynote presentations by the workshop co-facilitators were made following the opening remarks and are presented in Section 3.

The main body of the workshop consisted of a series of concurrent "break-out" work group sessions to discuss the draft soils, vegetation and landscape criteria. An overview of the break-out groups is presented in Section 4. The workshop concluded with an open plenary presentation of the break-out group findings/observations. This information has been transcribed and reproduced in Sections 5, 6, 7 and 8 of these workshop proceedings. Section 9 provides an overview and summation of the policy/issues group discussions.

Section 10 provides some concluding comments to the workshop. Representatives of both government and industry summarized the key points of the workshop and provided some insights into the future direction of discussions and the formalizing of the *Reclamation Criteria for Wellsites and Associated Facilities*. These proceedings are concluded with a series of appendices. An outline of the workshop agenda (revised to reflect the actual workshop activity) is presented in Figure 1.

Figure 1. **Wellsite Reclamation Criteria Workshop Agenda (Revised)**

Wednesday, January 19

1. **Welcome and Opening Remarks**
- Larry Brocke, Alberta Environmental Protection
- Ian Scott, Canadian Association of Petroleum Producers

2. **Workshop Agenda Review**
- Bob Mahnic, Communiplan

3. **Communication and Issue Resolution**
- Bob Mahnic, Communiplan

4. **Wellsite Reclamation Criteria:**
4.1 Comment Review Process
- Bob Mahnic, Communiplan

4.2 Comment Review Results/Issues
- Len Knapik, Pedocan Land Evaluation

5. **Industry Review of Reclamation Criteria**
- Rob Staniland, Talisman Energy

6. **Break-Out and Plenary Overview**
- Bob Mahnic, Communiplan

7. **Break-Out Session I:**
7.1 Soil Criteria

Thursday, January 20

1. **Report of the Policy/Issue Group**
- Gary Webster, Canadian Association of Petroleum Producers

2. **Break-Out Session II:**
2.1 Vegetation Criteria
2.2 Landscape Criteria
2.3 Remaining Issues

3. **Plenary Session and Discussion:**
3.1 Soil Criteria
3.2 Vegetation Criteria
3.3 Landscape Criteria
3.4 Remaining Issues

4. **Workshop Evaluations**

5. **Concluding Remarks:**
5.1 Government Perspective
- Larry Brocke, Alberta Environmental Protection

5.2 Industry Perspective
- Gary Webster, Canadian Association of Petroleum Producers

2. WORKSHOP OPENING REMARKS

Mr. Bob Mahnic opened the "Alberta Wellsite Reclamation Criteria Workshop" by welcoming all of the government, industry and stakeholder group participants (Appendix E). Mr. Mahnic also acted as principal coordinator/facilitator throughout the two-day workshop.

Three plenary presentations by representatives of government and industry opened the Wellsite Reclamation Criteria Workshop. First, the workshop objectives and a brief overview of the wellsite criteria development process to date was stated. This was followed by two presentations on industry's perspective and experience with the draft reclamation criteria in 1993.

2.1 WELLSITE RECLAMATION CRITERIA: GOVERNMENT PERSPECTIVE

(Presented by Mr. Larry Brocke, Alberta Environmental Protection)

Good morning everyone and welcome to Red Deer. I thought it might be worthwhile this morning to retrace some of the steps that we have taken towards developing the new wellsite reclamation criteria. I hope this serves to explain why we started down this road and how we got to where we are today. I would like to mention what I would expect, from the regulatory side, to come out of this exercise and a few other things that need to be addressed before we kick off.

About two years ago a lot of concern was raised by people in the oil and gas industry – by us, by our external stakeholders and by landowners – about the process of wellsite reclamation and certification in the province. Some of the phrases we were hearing that related to reclamation certification was that it was "too subjective", "subject to people's wills and who gets up on the wrong side of the bed", "there's a huge backlog out there – what are you going to do with it", and "it takes too much time to deal with". These comments were coming from all of the stakeholder groups involved.

We recognized an important need to do something about the reclamation and certification process. One of the options being considered was to have a set of criteria written down so that everybody would be working from the same page. We kicked off development of the initial wellsite reclamation criteria in July, 1992. Alberta Environmental Protection representatives met with Public Lands and Forestry people, prepared an initial draft document, and it was distributed for comment. I had presented it at a CAPP conference in Calgary. In January 1993, we got together with industry and other stakeholders several times and re-worked it, to try and refine it with the idea that we were going to have a draft criteria package for industry to work with for the summer of 1993.

Many comments were submitted to our Department, identifying some of the difficulties with the wellsite reclamation criteria. In fact, the focus of this year's Canadian Land Reclamation Association, (Alberta Chapter) Conference which was held in Red Deer in November, 1993 was on the new wellsite reclamation criteria. It was probably the most highly attended CLRA conference held in Canada, with well over 300 people in attendance. A lot of good discussion on the criteria was noted at the conference.

What we need to do with the reclamation criteria now is massage it and refine it to make it into a workable package. In terms of the realities of today, though, it's even more critical that we come up with a package that is understandable and acceptable to everyone, one that we can work with.

Heading into the two days of workshop discussion, I would encourage you to focus on the technical aspects of the criteria. That's really important. Focus on the technical and set aside, as much as possible, the policy issues. I fully recognize there are some policy issues that are outstanding. There are a number of us here that aren't in the technical working groups that will get together and discuss these outstanding policy issues. The technical part of the criteria have to be workable for us to achieve our reclamation objectives. Express your best professional view. Also, I would encourage you to listen carefully to those that are in your group. Let them have their view and listen to it and discuss it. We're going to work this thing out.

Getting back to some of the policy-type issues – one that keeps resurfacing relates to the capability versus productivity issue as the objective or measure for reclamation success. I know it still concerns some of you. I would just like to express my view of this topic and the way we have adapted things in the province over the last 10 or so years. That relates to using the evaluation of land capability as the primary measurement of reclamation success. There are a number of reasons why we did that and a number of reasons why we steered away from crop productivity as a measure.

Capability amounts to a measure of the soil capability over the entire landscape. When assessing a small site, you really boil it down to the soil capability. What is the soil capable of doing? Our objective is to have you return it to a state that was as capable as it was before commencing wellsite activity. There are certain things to evaluate at a point in time that will give you an indication of capability. That's what the whole criteria package was built on. The things that you look at and the things that you measure or evaluate to try to put a number on are soil characteristics, soil properties that over the years have led to researchers to say "if you have these characteristics, this will happen". One reason for using capability measures is to meet the time factor in enabling us to deal with certification. The down side of productivity in that regard is that you may have to assess and measure it for a long period of years to average out the differences in soil properties, differences in management and differences in climate conditions. In the United States, for example, some states use productivity as their measure for evaluating reclamation success. It's generally a minimum 10-year evaluation period, based on measuring crop yield. This time frame does not meet our time requirement. On the other hand, we know that crop vegetation production is important, that it can tell you different things than just strictly looking at soil properties. That aspect has been factored into the wellsite reclamation criteria.

I'd like to reiterate the critical need for us to come out of the next two days with a document that we agree on and that we can use in the 1994 field season. If there are some points in the criteria that we cannot resolve here in the next few days, it means that the criteria will have to evolve through several updates in the future. In closing, I would like to thank everybody for taking an interest and investing your time for this important process.

2.2 WELLSITE RECLAMATION CRITERIA: INDUSTRY PERSPECTIVE

(Presented by Mr. Ian Scott, Canadian Association of Petroleum Producers)

First of all I thank you for the opportunity to make a few comments to open this workshop. My primary responsibility with CAPP is in pipelines although I have been involved with reclamation issues for many, many, years. I will limit my comments today to wellsites.

CAPP is concerned with the backlog of wellsites awaiting reclamation certification in the province and hence supports any changes to the reclamation criteria that helps to eliminate the backlog. We welcome the opportunity to work with Alberta Environmental Protection and others here to develop criteria that are clear and concise and yet practical. CAPP's fear is that the criteria, as they are currently written, do not provide enough certainty for industry for wellsite reclamation.

Problems with the criteria have been identified in the past few months and will again be addressed over the next few days. For example, industry believes there is a need for more flexibility in determining whether a site ultimately passes or fails. Is it appropriate and/or feasible to have criteria that apply to all regions within Alberta or should there be different criteria to accommodate regional variabilities? As well, can there be special provisions or should there be special provisions for sites constructed during winter given that there are so many external factors which can dictate winter construction. These are a few of the problems that have been identified and that you will be discussing over the next few days.

Everyone here today, whether from industry, government or some other affiliation brings their own expertise and experience to the table. You all have an important part to play in the process. This is your opportunity to articulate your views, provide alternatives and hopefully come to some resolution of what constitutes acceptable wellsite criteria. In your deliberations I would encourage you to remember the three c's, communicate, cooperate, and where necessary, compromise. This workshop is part of a dynamic process. As we learn more about wellsite reclamation through implementation of the criteria, I believe that there will be need to redefine and to fine-tune the reclamation criteria. Therefore I suggest that consideration be given to a periodic review of the effectiveness of the new wellsite reclamation criteria.

Although the focus of the workshop is to deal with wellsite reclamation upon abandonment, CAPP would be interested in knowing if there will be value in developing specific guidelines which address some of the concerns associated with the lease preparation in order to reduce the potential for problems related to certification.

As well, I would suggest that whatever is developed over the next few days be reviewed periodically to assess their effectiveness. Would it be appropriate to consider whether there is a need to establish a reclamation committee similar to what we currently have in the pipeline industry (the Alberta Pipeline Environmental Steering Committee - APESC)? The pipeline group meets quarterly, has representatives from Alberta Environmental Protection, the ERCB, industry and other stakeholders. I think this has shown to be a very effective manner in which we can focus on problems related to specific issues on an ongoing basis rather than waiting until a number of problems arise. I think that there should be some consideration to set up a similar group to deal with wellsite reclamation.

I know you all have your own agenda but I think at the end of the day we all have to work together to try to come up with some guidelines and criteria that are precise, clear and practical that we can all work with. Thank you.

2.3 WELLSITE RECLAMATION CRITERIA: INDUSTRY'S EXPERIENCE IN 1993

(Presented by Mr. Rob Staniland, Talisman Energy)

Several companies went through the considerable effort of completing wellsite assessments based on the draft criteria in 1993. Although I haven't been able to access documentation on all of the assessments, I have examined a fair number of them. In reviewing the information, a few things pop up as fairly constant difficulties with the draft wellsite reclamation criteria.

One of the biggest difficulties I had concerned the sometimes significant variances between the different third parties and consultants that were completing the field assessments and certification reports. Some of the reports submitted were not completed. Quite frankly, in some instances, if you weren't the person who did the assessment and you had to read the reports, you wouldn't be able to conclude from these reports whether the site had passed or failed from an intuitive level. In many instances, not enough information was recorded to properly assess the wellsite.

In tabulating the various reports, the range of pass/fails for different land use is basically this – 75% to 85% of the wellsites examined under the draft criteria failed. If one holds strictly to the draft criteria these sites failed fairly obviously.

I looked at what industry considered the worst case scenario and I'll provide a quick run-down on some numbers. After tabulating the results for a number of different scenarios it soon became obvious that there was too much information to deal with. There were many reasons sites were failing, although, intuitively, field investigators had a hard time believing such a large number of sites should be failing.

Quite a large number of Green Area sites were examined. These should be some of the least contentious to assess, but by the draft criteria (mainly landscape criteria), 73% of the wellsites assessed would have failed. In some cases it was the small onsite sumps that were now causing failures. These would require some minor recontouring and they all had complete vegetation cover, but strictly by the draft criteria, they wouldn't pass.

I have assembled two sets of data from what I call the "reconstructed locations". These are primarily in the black soil zone. In one group I had good information provided on how much topsoil borrow went in to try to build to these criteria. This was before the reclamation assessments were done. For one group of 50 sites probably 15,000 cubic metres of topsoil was borrowed in to meet the criteria requirements. Despite this considerable expense and activity, 82% of those sites still failed the draft reclamation criteria, primarily on topsoil depth distribution. Another series of assessments (about 100 sites) done by another company indicated the need for significant borrow and rework to be done. Again 84% of them failed.

Part of the implication of this criteria is that if you fail then you have to re-work your sites to acheive the criteria. In a lot of cases, it just does not make economic or practical sense. There was another set of information that I did look at in detail. This was a series of approximately 80 site assessments done primarily in central Alberta. Again, they hold to the pattern of 84% failures.

The whole point of this is fairly obvious – the draft criteria are not practically-oriented. The proposition is that these sites really in fact are not that badly impacted and don't deserve that much more reclamation effort before receiving certification. If government is wondering why a lot of the reports hadn't been sent in, perhaps part of the reason for that was the fact that these numbers indicate so many outright failures according to the draft criteria. At this point in time there is very little belief that there is much consideration being given for "failures, but with justifications". I'm quite optimistic that there will be some kind of movement on the pass/fail aspects of the criteria.

The draft criteria has flagged a number of site failures that, from a capability or reclamation practicality standpoint, were considered insignificant. I wanted to examine the field assessment data to see whether there was any point to recommending use of a measurement tool that doesn't discriminate whether further site reclamation work really has to be done or not. Thank you.

2.4 QUESTION PERIOD

Question.	You mentioned that in your review, there were many failures because of compaction. You mentioned the problems with distribution of the topsoil but not much about compaction.
Staniland.	One of the groups of information I reviewed included about 80 sites where 84% of them failed. The consultant had indicated that the bulk of the failures were due to soil compaction in that area. The reason they disagreed that the sites failed (as indicated by the draft criteria) was that, in virtually all cases, there was no evidence of compaction being a problem when examining the onsite vegetation growth. If you call it compaction that implies it has a double tiered-standard. If you consider it "tightening", we can go out there and measure tightening and the big question then is – is that

important or not? Is it worth going back into the site to try and fix? Is it having any effect on crop? In the consultant reports a lot of problems with the compaction criteria were noted. That was their primary problem – they didn't have a topsoil problem. That conflicts with about 150 sites I've reviewed where there probably was compaction. That's part of the discrepancy I was seeing between the different people working on this criteria. What they appeared to be doing was spending most of their effort on what they assumed would be most important or what they were most familiar with.

Question. I guess it just points out that you really can't set up a criteria that will work across the whole province in regards to something like compaction. In my area, compaction would have an effect on the crop, however it could be dealt with by deep-ripping the topsoil. In other areas that would probably be more detrimental to the land and so I'm a little concerned when you start talking about criteria that's going to work in all situations. You will have to consult the landowner in a lot of cases and the district agricultural people to find out what you should be doing on a site by site basis.

Staniland. I won't disagree with that. That was one of the complaints about part of this process of trying to develop a single set of reclamation criteria so it could be done quickly and decisions made more efficiently. I think that this workshop is going to have to work on what kinds of tolerances need to be built into the criteria. For your example, perhaps we need to consider the combined effects of compaction and admixture. If you have compaction what will you do? If you have to restrip, can you do it without causing further damage? What are the implications? I know we need to keep it (reclamation criteria) as simple as we can but if it gets too simple, will it produce anything at all?

Question. If you're ready to wait, compaction will take care of itself because nature works on the land and eventually it will come back to what it was. But it can take a long time for reclamation to take place in areas of high compaction.

No response.

Question. Rob, I really appreciate the fact that you have taken the time to pull those industry numbers together because it's really important for everyone to hear that. I wonder if there's an opportunity for those numbers to be written up and included in the workshop proceedings? I think that gives people a good feel of what happens in the real world. It would be a shame to lose the work you've done so far.

Staniland. Yes, although I have compiled several different levels of information. At one level, I had tabulated about half a page on each wellsite and from there I tried to isolate why the sites were failing. I could summarize that information (editorial note: Rob Staniland's wellsite reclamation summary tables are included in Appendix F of these proceedings).

Question. Do we have any indication from government what they thought the pass/fail mark was going to be with the original criteria? Is there anybody who can give us some kind of indication of what they expected to find?

No response.

3. OVERVIEW OF WELLSITE RECLAMATION CRITERIA COMMENTS

Two summary presentations were made following the opening remarks from government and industry. The presentations covered two main topics. First, the process which was used by Alberta Environmental Protection to solicit comments on the draft *Reclamation Criteria for Wellsites and Associated Facilities* and the tabulation of the comment sheet responses into a database by Communiplan was described. The second presentation consisted of a discussion of some of the main trends or concerns identified in the comment sheet responses.

3.1 COMMENT SUBMISSION AND TABULATION PROCESS

(Presented by Mr. Bob Mahnic, Communiplan)

After the draft *Reclamation Criteria for Wellsites and Associated Facilities* was issued to oil and gas operators in early 1993, government requested comments on the field application of the draft criteria as well as the code of practice and other related issues. Letter responses were received from government, industry and stakeholder group representatives throughout the summer of 1993.

Following the initial letter response, Alberta Environmental Protection prepared a nine-page "fill-in-the-blanks" series of comment sheets (Appendix G). More than 40 completed comment surveys were submitted. Those completing the comment sheets are to be commended for their efforts. It certainly indicates where some of the main problem areas lie.

Each of the workshop participants received a cerlox-bound document which contained a selection of the draft *Reclamation Criteria for Wellsites and Associated Facilities* comment sheet responses. As well, a summary listing of all those people who submitted comments, letters or memoranda referencing the draft criteria is attached to these proceedings (Appendix H). Communiplan has entered this information into a database to aid in the analysis of comments on a topic-by-topic basis. The comment sheet responses and letter/memo responses are also appended to these workshop proceedings (Appendices I and J, respectively).

All comment sheet and letter/memo responses will be reviewed in the course of continuing discussions regarding the draft *Reclamation Criteria for Wellsites and Associated Facilities.*

3.2 QUESTION PERIOD

Question. I'm not clear, do the criteria pertain to forested areas as well as parkland? If it's for all areas of the province, there are a number of different questions we need to consider.

Mahnic. In the breakout sessions we're going to look at identifying some of those specific issues. Where the criteria don't seem to fit, one category or the other, identify your concerns and bring it into the plenary session for further discussion.

Question. Larry Brocke had mentioned that we should focus on the technical issues and leave the policy concerns alone. There was some further discussion about that last night and my sense is there might be some confusion as to what is a policy issue and what isn't.

Mahnic. Yes, that is a good question. What we'll do is wait until 11:00 and we're going to talk specifically then about the breakout group assignments and at that time I'll ask Larry Brocke for further clarification of the technical versus policy issues (see Section 4.3).

Question. Who selected the comment sheet responses at the end of the cerlox-bound document?

Mahnic. It's a summary of the more than 40 comment sheet submissions Alberta Environmental Protection has received to date. Out of the 40-plus submissions, we took 3 or 4 "representative" comments. Some people will think their own comments should have been in there. The selection was not directed to keep some comments out, it was just to show some of the depth and breadth of the discussion. Selection of the comments was made by our technical advisors for this workshop, Len Knapik and Tim Bossenberry of Pedocan Land Evaluation.

Question. I would find it useful if we could give credit to the people who provided the comments, to try to indicate who said what.

Mahnic. Rather than polarize people on a particular comment from an industry person or a consultant, or a government representative or a particular stakeholder we chose not to identify the individual respondent. In the full database, each submission is identified by a code number. What I've done is attached a list of all the people who have submitted comment sheet responses. Perhaps this helps you to see where some of those comments may be coming from.

3.3 COMMENT SHEET REVIEW AND GENERAL OBSERVATIONS

(Presented by Mr. Len Knapik, Pedocan Land Evaluation)

With the direction to focus on the technical aspects of the draft Wellsite Reclamation Criteria, I would beg your leave to not start at the beginning of the comment sheet. In general, the comment sheet responses tended to show the polarization of viewpoints between the field and the office. The office "moles", both government and industry, tended to share more common opinions than the field "mice" did about the same issues. I think that is an important distinction and one that we will have to deal with in the break-out groups.

One comment that was mentioned many times was to improve the definitions. If the definitions are not clear, the expectations are not clear. Certainly, a wide group of people from varying backgrounds will be expected to interpret and implement the new criteria and this requires a very clear definition of the terms that are to be used. We need to develop a better glossary to accompany the proposed criteria and we need to understand the terminology.

First of all, I will review the landscape criteria responses. In the draft criteria, drainage was to be consistent with original patterns, direction and capacity or compatible with surrounding landscape. The comments generally agreed that this is a reasonable criteria. There were some requests for better definition and allowances for special situations. Some people argued with terms such as "should be consistent with" or "compatible with". Those are fuzzy terms and some people want more exact terms. That trend of thought was found all the way through the comments – split between the people who want to have exact measurements and exact limits and the people that said we want flexibility and more reliance on professional judgement.

The initial reclamation criteria stated no more erosion gullies or blowouts than on adjacent lands. Most people agreed with that criteria. The contouring criteria essentially said that it should conform and blend and must be stable. Again the comment sheet responses essentially agreed with that with some allowance for exemptions. One comment that came up quite often was you don't need an operator to go back and recontour a site if it is part of a fragile landscape or if it is native prairie grassland pasture.

The stability criteria indicated where misuse of terminology was most evident. The responses typically included comments such as "problems are not always evident" or "this term is confusing, find a better one." If the commenter had added here is a way to determine the risk or future problems or how he might identify problems that are not evident it would help this process a lot more. Comments that just said "I don't like it" or "you should change it" are not as useful as those that offer a viable alternative. I would encourage that this afternoon. If you have a problem with a criteria, please offer a better one. If you can't think up a better one or don't know of a better one then maybe that's the best we have and we go with it.

The coarse fragments (rocks) criteria. Some people said "why don't you call them rocks or stones or gravel?" The main problem here was how do you measure or estimate the amount of rocks on the surface. Most agreed that it is difficult to eyeball or to tell the difference between 10% or 20% cover. Too subjective a measurement approach. Again, there were some people who wanted more accurate or precise measurement techniques and others who did not.

Some respondents said the landscape debris guideline should be changed to "no industrial or domestic debris, no woody debris buried or burial of debris which might cause stability problems".

The topsoil definition. The main thing that respondents identified was confusion over definitions – what is topsoil and what is surface soil? There are currently two definitions for what appears to be kind of the same thing. We need better clarification, better definition of these important parameters.

The topsoil/surface soil sampling scheme criteria. Some people said the number of sample sites are too many, some said they may need more sites. Relating to the number of samples along access roads, the point came up quite often about the length of the road having an effect. Choosing sample sites based on slope position or perceived problems or selecting on some place other than just a fixed grid also caused some problems. Some people suggested a first cut of 10 sites and then come back and do more if needed. Many different options have been suggested on the number of sites needed and the sampling design.

The control site sampling scheme criteria. There was some confusion over this issue in the responses I looked at. Some expressed concerns about trespassing off the lease and gaining access permission from landowners as being important surface rights issues. How many controls are adequate in variable situations also came up quite often.

Many different recommendations were made concerning the average soil depth replacement and the number of sites required for pass (90%, 80%, 70%, etc.) and much discussion around the different numbers based on the year of construction. For example, how old the site is may not be as important as the soils, land use, history of the site and the natural landscape. Many of the respondents indicated difficulty in accepting that a 90% return is possible, especially in winter construction conditions. Others felt that this is implementable and a reasonable set of numbers to achieve. Most acknowledged difficulties in estimating and assessing the quantities. I think this is probably the one criteria that spurred the most response and the most interest.

The major issue regarding the draft topsoil quality criteria was admixing. It's a problem that everyone seemed to have an opinion on. Can you estimate the percentage of admixing with any amount of precision or accuracy? Does admixing mean anything? Can you have admixing if you don't have change in texture or other soil properties? If vegetation is OK why worry about admixing? A lot of comments were expressed on the difficulties in understanding what admixing is, defining it better and problems in measuring it with precision or accuracy.

Next, we reviewed the topsoil/surface soil criteria: salinity. Most agreed with the concept that you should use visible salts or the use of vegetation to identify a possible salinity problem.

The coarse fragments criteria. Again, the same comments as earlier under the landscape section – it is difficult to estimate with accuracy.

Comments about the topsoil compaction criteria included "it's difficult to test" and "too subjective". The main differences in compaction measurement were between people who said "I want a quantitative measure with a penetrometer or some such device that gives me a hard number and removes a lot of the operator error." If they're using a screwdriver or shovel or whatever they won't get that hard quantitative measure. The influence of different soil moisture conditions on soil strength and compaction was also identified as a concern.

The subsoil sampling scheme criteria. Comments ranged from "why?" to "for what reason?" to "it's ok." There were a considerable number of "ok's." We surmised this came either from no experience or a lot of experience but they didn't document why they said ok.

The subsoil criteria: salinity. A wide variety of responses. Some stated that if salinity is suspected, get some samples. Many respondents indicated they were not very comfortable with visual assessment of subsoil salinity problems.

The subsoil criteria: coarse fragments. Most indicated measurement problems. Difficult to estimate. What does it mean? The subsoil compaction criteria. Again, many emphasized the need to standardize the measurement technique. Another concern expressed was that subsoil compaction could be the only problem to fail a site. Others suggested the use of plant indicators as an override to qualify subsoil compaction issues.

The vegetation must be present at assessment time criteria. There were a variety of opinions on this issue. The length of time vegetation must be present criteria. Again, a wide variety of comments – one year . . . two years . . . must be over the winter. The variety of comments related to different situations, different soils, different climatic zones and different land uses.

The species composition criteria. Most respondents were generally in favor of this criteria as is. The height and density criteria. Comments couched in terms of some of the changes in qualifications and how you can use it. What is realistic at different sites and situations?

The vegetation cover criteria. Several indicated the need for comparisons to adjacent areas. How much cover is enough cover? What is achievable? What does it tell you about site conditions? The vegetation rooting criteria. There were a few comments in terms of how this might be a better measure for compaction problems.

The vegetation: bare areas criteria. There was some confusion as to whether it was a clue as to where you might need some further investigation and for sampling. Is it a criteria in itself? There is some confusion about the terminology.

Vegetation criteria - general. Some respondents felt the vegetation criteria were rather vague in the initial criteria. Other comments varied from "not necessary" to "get rid of it" to "need more explanation."

The Level II Assessment. Many of the respondents indicated that they were not sure what was meant by a Level II Assessment. Some thought we didn't need Level II and others thought Level II should be done before Level I. There were a wide variety of responses on this subject.

General comments on the Reclamation Certificate Application Form. These varied from saying that the form is too rigid to saying it was good. Several suggested including comment sections to write short explanatory notes or to explain things. It was suggested that the form is not user-friendly. Others questioned the need for five copies of the survey plan. With regard to site histories, many expressed their concern that there is a lack of available site information for older sites. The declaration section of the form also had quite a range of response. Some people are quite uncomfortable with it. Most seemed to think it was ok. What are the legal implications of certifying that there are no soil chemical or physical conditions that resulted that may adversely affect soil or groundwater?

That provides a summary of my observations from the submitted comment sheets. As you can see, some issues remain more contentious than others. I encourage you to more fully discuss these important issues in your break-out groups.

4. WORKSHOP COMMUNICATIONS AND PROCESS

This section of the proceedings provides an overview of workshop communications, issue resolution processes, the break-out group assignments and plenary session process. As well, a discussion concerning the reclamation criteria technical versus policy issues is presented.

4.1 WORKSHOP COMMUNICATIONS AND ISSUE RESOLUTION

(Presented by Mr. Bob Mahnic, Communiplan)

I want to talk briefly about workshop communications and issue resolution. First, effective workshop communication. The technical and policy discussions we will participate in over the next two days will provide each of us with an opportunity to communicate – as a technical expert, as a policy discussant, and as a participant-observer. I and my co-facilitators look forward to working with each of you to help uncover the shared experiences of the diverse groups represented here.

The main reason we are here is to communicate. The more involved you are in the discussions, the question periods and the plenary sessions, the better this workshop is going to be and that translates into better recommendatons and future plans. Each of you is responsible for listening and contributing positive ideas and suggestions.

What can we hope to accomplish in just two days? Well, perhaps we can share some important information with each other. Most of us are familiar with the axiom *"information is power"*. If we extend ourselves to communicate effectively then perhaps we can also extend the axiom to *"the ability to use information is power and, therefore, information shared is power multiplied"*. I think we need to keep this in mind throughout the workshop deliberations.

With respect to issue resolution, what we are going to try to accomplish is basically the cycle of constructive conflict management. Four main elements need to be examined. First, identify what's happening. Second, identify how you feel about this event or occurence. Third, take a step back and look at the wider view (other people's experiences). Finally, respond positively. Probably the most important element of communication is not speech but listening. Listen carefully to what is being said in the break-out groups and plenary sessions and then generate your response.

Do you believe in win-win negotiations? You have to believe that you can come to resolution and closure on the majority of issues. There will be outstanding issues and they'll have to be dealt with after this workshop and that's understood. That's part of the assignment of the policy/observer group – to look at implementation of the reclamation criteria. You have to believe it's possible to solve problems. You have to believe that we can deal with the complexities of life and the complexities of these criteria. Understand and be sympathetic to the views of others, to the perceptions of others and to the feelings of others. Be realistic, be reasonable, be responsible in your approach.

4.2 BREAK-OUT GROUP ASSIGNMENTS AND PLENARY SESSIONS

Each of the sixty workshop participants was assigned membership in one of four technical break-out groups or the policy/observer group. The technical break-out groups were responsible for an item-by-item discussion of the draft *Reclamation Criteria for Wellsites and Associated Facilities*. On the afternoon of Day 1 of the workshop, each of the break-out groups discussed the soils-related criteria. On the morning of Day 2, the groups reviewed both vegetation and landscape-related criteria.

The policy/observer group discussed a "menu" of non-technical issues relating to the draft criteria on Day 1 and Day 2 of the workshop, as well as periodically observing some of the discussions of the technical break-out groups.

Many suggestions regarding the draft *Reclamation Criteria for Wellsites and Associated Facilities* were made in the four technical break-out sessions. These are noted in Sections 5, 6, 7 and 8 of these proceedings. Comments made in the plenary sessions are also noted in the main topic areas of soils, vegetation and landscape. The group facilitators (Messrs. Bossenberry, Knapik, Mahnic and Mott) presented summaries of this material in the plenary sessions.

The policy/observer group recommendations are presented in Section 9 and 10.

The break out group members are listed alphabetically below, following the group facilitator (a listing of all workshop participants, including their company/department/agency affiliation and home office location, can be found in Appendix E):

An alphabetical listing of all **Group 1**members follows:

Len Knapik (facilitator) Jim Burke, Lowell Calder, Perry Gerwing, Tom Grant, Leonard Leskiw, Brian Mario, Michael Melnyk, Les Miller, Don Norrie, Peter Zimmerman.

An alphabetical listing of all **Group 2** members follows:

Tim Bossenberry (facilitator), Jerry Bulman, Terry Forkheim, Kandy Hubl, Keith Lyseng, Rick Ostertag, Ian Proctor, Stephen Skarstol, Daniel Slaght, Jim Smith, Don Welsh.

An alphabetical listing of all **Group 3** members follows:

Bob Mahnic (facilitator), Alvin Billings, Roger Buxton, Barry Cole, Neil Drummond, Al Fedkenheuer, Ken Heemeryck, Don Jackson, Arnold Janz, Keith Stretch, Fred Van Ingen, Ralph Woods.

An alphabetical listing of all **Group 4** members follows:

Gary Mott (facilitator), Jeff Biegel, John Bradley, Colette Cloutier, Jeff Hartley, Gary Mandrusiak, Nancy Finlayson, Don Rogerson, Gerard Testa, Don Thompson, Linda Walton, Ivan Weleschuk.

An alphabetical listing of all **Policy/Observer Group** members follows:

Murray Anderson, Larry Brocke, Heather Gerling, Dan Grahn, David Lloyd, Chris Powter, Bruce Riep, Ian Scott, Rand Smith, Rob Staniland, Sam Takyi, Gary Webster.

There was one other important information resource that was made available to all workshop participants - a series of updated Wellsite Reclamation Criteria comments (Appendix K) presented by the Department's of Environmental Protection and Agriculture, Food and Rural Development (Public Lands). This document was developed as a result of their recent internal discussions and provided some further information for the breakout groups to consider.

4.3 QUESTION PERIOD

Question. I had asked earlier about getting some clarification on what we are supposed to consider as policy and what is to be considered as technical.

Brocke. There's been a list of specific policy issues put together that the observer/policy group is going to discuss throughout the day. To answer your question, the best I can do is to identify a few of the policy issues we will be considering. We will talk about those issues or concerns that aren't directly related to the technical aspects of the criteria. One of the policy issues we will discuss is the capability versus productivity issue. We don't want that to cloud the discussion in the technical end of the criteria. Another policy issue we will be discussing is the reconciliation of the use of professional judgement – common sense versus the absolute application of the reclamation criteria. One of the things I was going to talk about in closing tomorrow afternoon was that there needs to be an ongoing provision for meeting and reviewing the reclamation criteria either annually or semi-annually. The winter construction issue also needs to be addressed. It's not necessarily a policy item but it has been mentioned as an important aspect of the reclamation process.

Question. It's hard to stay away from the wet/frozen issue. It's not an ideal world out there and half of our work is in wet or frozen conditions. For me to go through these criteria and compare them under less than ideal conditions, I cannot say that they will work.

Brocke. I wasn't trying to imply that. All I said is don't concentrate on the non-technical issues. That's where the application of common sense and consistency of approach comes in. Just recognize the problem and try to move on.

Question. In the context of the evolution of training I agree with Larry Brocke. Don't get hung up on the training needs at this time. I think there's a real opportunity with the people here to identify areas where you think there are deficiencies in training. Are people qualified to do the work and to demonstrate their diligence? It is important to express your ideas where there are some deficiencies in training and at least itemize this problem.

No response.

Question. One issue that I would like some clarification on before we begin our technical sessions is the application of the criteria in the Green Area. My sense is that in dealing with the different forest districts, there are different management techniques applied in different parts of the Province. I would like some clarification as to whether or not when we are dealing with the technical issues that they will be applied consistently between White and Green Areas or whether we're going to move the Green Area aside and deal with it as a separate issue.

Response. I think it's important to remember that the criteria package is a tool and like any other tool you're going to hopefully use it to your advantage. There are differences in the Green Area versus the agricultural areas and that's recognized in the reclamation criteria. If there are serious inconsistencies between Forest Districts then that also needs to be dealt with.

Question. I'm bringing these things up from different people that I have talked to in preparation for coming here. There seems to be some confusion with the folks I have talked to as to how the criteria was going to be applied in the Green Area. What I hear sounds like a reasonable approach – that there's going to be flexibility, there will be emphasis on different things, different parts of the criteria and different areas.

No response.

Question. How much of the Green Area affects your total reclamation package. If you have, say 5,000 wellsites, are 1,000 of them in the Green Area? What is the ratio?

ERCB response. We don't keep our data on Green Area or White Area. We could probably get a number from our database but we couldn't give you that number right now.

Brocke. Based on the request for certificates that we get annually from both groups (White and Green Area) I think it's pretty close to even – there are as many wellsites in the Green Area as other areas.

Question. Getting back to this idea of policy versus technical. If in the breakout group, we have a Forestry person and a person that's more concentrated on agricultural areas or White Area, do we address them separately if there is a conflict in how these technical matters play out or do we say "sorry that's an issues thing and we can't cover it".

Response. The whole reason for the variety of people that we've chosen to come here was to get some of that practical opinion on it. Someone who can actually look at it and say that's just not going to apply where I am. I think we've got to have the dual input. If you're really choking on it and it's got to be dealt with in a dual manner depending on land use, then I think we should deal with it in a dual manner. My presumption is you're going to treat some of these parameters differently. You may call it the same parameter, it may require two totally different treatments. There is obviously a different emphasis on what's important in the Green Area and what's important for agricultural lands.

Question. Is there an opportunity in the agenda to have the policy/observer group report back to the group in plenary?

Mahnic. Yes. One form will be a summary report presented in the plenary session to comment on some of the things they have discussed. The second form will likely occur when we start to discuss these issues item by item. Once we have completed the technical discussion, it may be appropriate in some instances to get some feedback as to whether there is a policy aspect that needs to be considered.

5. BREAK-OUT AND PLENARY SESSION: SOIL CRITERIA

The first break-out group assignment was to discuss the soils-related criteria. Break-out group participants were encouraged to have their specific concerns recorded, with an objective to work towards resolution of the outstanding issues. Following the listing of the four technical group responses are comments and feedback presented in the plenary session. The soil criteria information was presented with the aid of flip-chart materials produced by the break-out group facilitators. Plenary session comments were transcribed from audio-tape recordings.

5.1 TOPSOIL/SURFACE SOIL DEFINITION

5.1.1 Group One Responses

* New definition from 1994 onward.

* *SURFACE SOIL DEFINITION*
- uppermost mineral/organic material, valued as a growing medium and salvaged. Defined for:

Cultivated Areas
= plow layer (Ap)
+ any Ah-Ahe, or + "similar" (could be a B)
to maximum depth = 50 cm
- single stripping/double stripping (depends on suitability of resultant material)

Grassland Areas - Uncultivated Grassland
- minimum = 10 cm
- maximum = 50 cm

Forest Areas - Soils
- surface soils = duff + 10 cm, or
if potentially arable = duff + Ahe (dark gray)

Forest Areas - Peat over Mineral
- to mineral layer, maximum 50 cm (for stable base)

Forest - Thin Peat over Mineral
- to mineral layer (max = 50 cm)

Peat Areas - Deep Peat
- no strip (pad)

Peat Soils
- cultivated - plow layer to maximum depth = 50 cm
- potentially arable = no strip

* *SUBSOIL DEFINITION*
- bottom of B horizon, or change in colour or texture

5.1.2 Group Two Responses

* ***TOPSOIL DEFINITION***
- use government definition (Appendix K)
- colour change (brown)
- root mass
- A horizon
- specific for cultivated land
- relate to end land use
- maximum depth (not resolved)
- relating to Ae, need flexibility to define

* ***SURFACE SOIL DEFINITION***
- use government definition (Appendix K)
- non-cultivated land only
- add: "in certain situations all of the Ae horizon may not necessarily be salvaged."

5.1.3 Group Three Responses

* ***TOPSOIL DEFINITION***
- Ae (ashy-grey horizon; grey-wooded) revision to include Bm (Brunisols)
- need workable soils, therefore Ae and Bm may be necessary
- Ae is used in farming
- old definition is ok (plus B horizon - better for province-wide)
- physical handling is important
- 40-year old sites: revise to state "adequate seed bed material."

* ***SURFACE SOIL DEFINITION***
- suggest AB and B materials must be of favourable quality
- revised version acceptable (Appendix K)

5.1.4 Group Four Responses

* ***TOPSOIL DEFINITION***

- Topsoil is defined as all "A" horizon (Ah, Ahe, Ae, AB and Ap) material within the soil profile, subject to thickness of horizons (and how topsoil quality is affected by inclusions of excess inferior quality of Ae.

- Ae or AB horizons will have to be salvaged with the topsoil or separately salvaged. When the Ae or AB horizons are salvaged with the topsoil, the control for the quality comparison must be a mix of the topsoil and the Ae or AB horizons.

- Organic soils and soil layers will also be salvaged and replaced. Shallow organic layers (L, F, H and O layers) will be incorporated with the top soil. Deeper organic layers will be assessed to a maximum depth of 40 cm.

- In certain cases, the above requirements for organic soils may be waived (e.g. padded roads/leases) by the Reclamation Inspector where negative impact is predicted. "Root zone" preparation will still be required.

- ***SURFACE SOILS DEFINITION***
  - The uppermost mineral and organic soil materials (to a minimum depth of 15 cm of mineral soil), or soil salvaged to a specific depth, which is valued as a growing medium. The salvaged soil must include all A horizon materials and may include all or part of any organic (L, F, H or O) horizon, or part of a suitable B horizon.

5.2 SOIL SAMPLING SCHEMES (TOPSOIL/ACCESS/CONTROL)

5.2.1 Group One Responses

- ***SAMPLING - SURFACE SOIL***
  - minimum from 10 to 25 samples
  - no maximum
  - cultivated = 25 (cutback in 1 to 2 years)
  - grassland = 25
  - forest = 9 (+ sump)
  - access road (cultivated and grassland)
    - very short (<100 m) = 2 sites
    - 100 m to 1 km = 1/100 m
    - >1 km = 1/250 m
  - access road, no sample points if uncultivated
  - winter access, no stripping

- ***CONTROLS FOR LEASE***
  - minimum = 4
  - pre-assessment holes = controls (yes)

5.2.2 Group Two Responses

- ***TOPSOIL/SURFACE SOIL - SAMPLING SCHEME***
  - tracking of sites
  - may evolve to less number of points
  - a reduced sampling scheme for Green Area
  - minimum of 10 per site
  - includes sump, flare pit, etc.
  - relates to degree of confidence as to how the lease was reclaimed
  - relates to rent paid on sites.

- ***ACCESS ROAD SAMPLING SCHEME***
  - use government statement (Appendix K)
  - qualify, i.e., only applies to disturbed access
  - no sampling on undisturbed access
  - explanation related to disturbance required on form

- ***CONTROL SITE SAMPLING SCHEME***
  - pre-construction information replaces off-site control sites, or minimum of four
  - trespass concern

5.2.3 Group Three Responses

* ***TOPSOIL/SURFACE SOIL SAMPLING***
- sampling = "original" criteria ok
- can "edges" be used as control points?
- use of "step-out" samples
- sandy areas/construction in winter -- should not require sample
- does "vegetation over-ride" reduce sampling need in some cases?
- if, at a minimum, 30 x 30 grid, option: access, sump, centre, flare
- assessment in set pattern

* ***ACCESS ROAD SAMPLING***
- paired vs Ditch/Centre/Control (100 m standards)
- sampling distance
- eliminate sampling on non-disturbed areas
- additional samples where topography (side cuts) dictate

* ***CONTROL SITE SAMPLING***
- same as access roads
- off-site access? not for criteria

5.2.4 Group Four Responses

* ***ACCESS ROAD SAMPLING***
- 10 sites per lease probably acceptable for some public lands (non-arable and Green Area)
- will be sampled subject to topographical features, not necessarily at a regular interval
- sample scheme, . . . amended proposal ok (Appendix K)
- ditches and crown: ditches in alternating sequence. Minimum of 2 sites on each roadway
- non-disturbed access (e.g. winter trail) may be waived

5.3 TOPSOIL/SURFACE SOIL QUANTITY

5.3.1 Group One Responses

* ***TOPSOIL DEPTH***

Grassland
- same as cultivated

Forest (duff + 10 cm)
1. replace and distribute evenly (replace all > 5 cm)
2. successful vegetation:
    - pre-1983 = use vegetation only, (don't need to check soils)
    - 1983 - 1992 = use yes/no, but qualify with vegetation

Topsoil Depth Issues
- depth qualified by admixing
- problems with variability in controls - range? average?

Peat
- if stripped:
    - must replace
    - must redistribute evenly (+/- 50% of mean)

* ***SURFACE SOIL QUANTITY - CULTIVATED***
- 1993 onward
    - Average 80% + 90% of sites > 80% of control and 100% of sites > 40% of control
- 1983 to 1992
    - Average 60% + 90% of sites > 80% of control, if 60% fail then 100% > 40% of control
- need "with explanation" or "with mitigation" (vegetation over-ride recommended)

5.3.2 Group Two Responses

* ***TOPSOIL QUANTITY***
- percent of average depth replacement
- topsoil:
    - 90% impractical in thin soils
    - use 80%; same as surface soil
    - pre-1983: 70% (industry-cannot agree)
- need another year of testing to formulate percentage
- distribution statement OK
    - topsoil: 80% of 80%
    - topsoil 1993: 80%
    - topsoil 1983-1992: 80%
    - topsoil pre-1983: 70%
- drop classes 5 and 6 (not total agreement)
- needs further testing

* ***SURFACE SOIL***
- 1993 = 80%
- 1983-1992 = 60%
- pre-1983 = use vegetation

5.3.3 Group Three Responses

* ***TOPSOIL/SURFACE SOIL***
- compactness
- a problem which rectifies itself over time
- suggest "ripping"
- needs closer landowner involvement to achieve reclamation success
- fix the problem – do not buy out
- "rutting" can also be treated initially
- use of better machinery

* ***TOPSOIL QUANTITY***
- retain CLI 5 and 6
- $\geq$ 50% and add CLI 4 (majority)
- question: climate and landscape limitations?

- *TOPSOIL/SURFACE SOIL QUANTITY*
  - surface soil: need exemption for well-vegetated sites or exceptional sites (minimal surface soil)
  - pre-1993 = default to vegetation

- *TOPSOIL/SURFACE SOIL DISTRIBUTION OF AVERAGE SITES*
  - accept revised criteria
  - older sites: topsoil import as a last resort
  - is 15 cm minimum depth acceptable?
  - is a separate set of criteria for older sites, i.e., 30 to 40 years, required?

5.3.4 Group Four Responses

- *TOPSOIL/SURFACE SOIL QUANTITY*
  - private land and cultivated public land
  - topsoil:
    - percentage as measurement (depth)?
    - percentage should relate to original (control) topsoil depth, or to a minimum requirement for topsoils with <10 cm original depth
    - need consideration of poor arable and thin Green Area circumstances
  - surface soil:
    - accept first two paragraphs of amended proposal (Appendix K)

5.4 TOPSOIL/SURFACE SOIL QUALITY - PERCENTAGE OF ADMIXING

5.4.1 Group One Responses

- - an indicator
  - concern only when it degrades surface soil
  - admixing can be: positive, negative, neutral
  - measure by:
    - structure
    - aggregate strength
    - texture
    - colour (landowner perception)

- 1. "inflates" surface soil depth
  2. is visible and is considered (right or wrong) to be negative
  3. only reduces capability when is negative:
     - if negative effects on texture, aggregate structure or aggregate strength, then:
       - discount surface soil replacement depth
       - 25% admixing = 25% discount

5.4.2 Group Two Responses

- - may not be bad
  - if 30% admixing, but productivity good for two years, texture same, consistency same, no problem if justification of the above

5.4.3 Group Three Responses

* - deleting admix has effect on topsoil percentage
- organic matter has value
- may require lab testing
- measure of topsoil loss
- replace with OM as measure?
- texture, structure as complimentary measures
- delete as measure method, too subjective (majority of group)
    - difficult to measure
    - likely to fail winter construction
    - would be captured under vegetation measurements
    - addressed in other criteria
    - limits options on older sites/poor topography

5.4.4 Group Four Responses

* - problem with 20% factor/measurement
- use as an indicator - not as separate criteria.
- other criteria reflecting the "impact" should be sufficient (e.g. structure, texture)

5.5 TOPSOIL/SURFACE SOIL QUALITY - TEXTURE TRIANGLE

5.5.1 Group One Responses

* - no response

5.5.2 Group Two Responses

* - use normal texture triangle? no
- needs more discussion
- if worm test used; need broad categories

5.5.3 Group Three Responses

* - accept "revised" version (Canadian Soils Classification, Appendix L)
- options:
    - soil quality criteria
    - use "original" criteria

5.5.4 Group Four Responses

* - accept "revised" version (Canadian Soils Classification, Appendix L)

5.6 TOPSOIL/SURFACE SOIL QUALITY - AGGREGATE SIZE AND STRENGTH

5.6.1 Group One Responses

* - no negative change in quality class, as in Level 2

5.6.2 Group Two Responses

* - seed bed quality compared to control
- define aggregate

5.6.3 Group Three Responses

* - ok as is (original criteria)

5.6.4 Group Four Responses

* - ok as is (original criteria)

5.7 TOPSOIL/SURFACE SOIL QUALITY - LAYERING

5.7.1 Group One Responses

* - delete
- support the root/water movement approach
- needs work
- check Reclamation Capability Classification
- delete other subsoil criteria

5.7.2 Group Two Responses

* - delete

5.7.3 Group Three Responses

* - delete

5.7.4 Group Four Responses

* - use Soil Profile Assessment instead

5.8 TOPSOIL/SURFACE SOIL - SALINITY

5.8.1 Group One, Two, Three and Four Responses

* - delete

5.9 TOPSOIL/SURFACE SOIL - COARSE FRAGMENTS

5.9.1 Group One Responses

* - call this category "rocks"

* *SURFACE SOIL*

- volume percentage of coarse fragments

Cultivated

- if <10 cm, allow 10%
- for 1993, onward > 10 cm, allow 0%
- if rocks, pick
- if gravel, screen

* *TOPSOIL*

Grassland

- 1993, onward: allow +20% (possible landowner problems)
- older: use vegetation - if good grass, leave it.

Forest

- no vegetation impedance

Peat

- no vegetation impedance

5.9.2 Group Two Responses

* - same as government statement (Appendix K)

5.9.3 Group Three Responses

*
- non-cultivated public lands
  - remove 80% (>3 cm)
- private and cultivated public lands
  - tolerance of 10% (>10 cm)
  - increase to 20% (≤10 cm)
- important to landowner relations/labour-intensive
- use "original" criteria
- evaluate from an equipment point of view

5.9.4 Group Four Responses

*
- public lands:
  - non-cultivated public land – 20% (amended proposal, Appendix K)
  - no requirement for Green Area (where wood production is primary use, rocks not an issue unless pitted or windrowed)
- private lands:
  - cultivated ok
  - non-cultivated: industry has problem with higher allowance on CLI Class 4+ at 20%

5.10 TOPSOIL/SURFACE SOIL - COMPACTNESS

5.10.1 Group One Responses

* - delete

5.10.2 Group Two Responses

- * - delete

5.10.3 Group Three Responses

- * - delete

5.10.4 Group Four Responses

- * - accept Soil Profile Assessment, but don't agree on number of assessment points.
- * - want five, in specific locations: flare pit, sump, well centre, access rod, entrance, storage area (industry preference)
- * - 40 cm, maximum, on balance of site (topsoil to transition)
- * - industry wants deep (50 cm) at five locations only
- * - government wants all to be 50 cm

5.11 SUBSOIL SAMPLING SCHEME

5.11.1 Group One Responses

- * Subsoil or Soil Profile Description to 50 cm / Sampling

	SURFACE	PROFILE
Cultivated	20 - 25	min 5 + control + road
Grassland	20 - 25	same
Forest	10	5
Peat	10	5

5.11.2 Group Two Responses

- * - delete

5.11.3 Group Three Responses

- * - delete

5.11.4 Group Four Responses

- * - use Soil Profile Assessment, but don't agree on number of assessment points
- * - want five, in specific locations: flare pit, sump, well centre, access rod, entrance, storage area (industry preference)
- * - 40 cm, maximum, on balnce of site (topsoil to transition)
- * - industry wants deep (50 cm) at five locations only
- * - government wants all to be 50 cm

5.12 SUBSOIL - SALINITY

5.12.1 Groups One, Two, Three and Four Responses

* - use Soil Profile Assessment, but don't agree on number of assessment points

5.13 SUBSOIL - COARSE FRAGMENTS

5.13.1 Groups One, Two, Three and Four Responses

* - use Soil Profile Assessent, but don't agree on number of assessment points.

5.14 SUBSOIL - COMPACTNESS

5.14.1 Group One Responses

* - use Soil Profile Assessment

5.14.2 Group Two Responses

* - delete

5.14.3 Group Three Responses

* - delete

5.14.4 Group Four Responses

* - use Soil Profile Assessment, but don't agree on number of assessment points

5.15 SOIL PROFILE ASSESSMENT

5.15.1 Group One Responses

* - delete

5.15.2 Group Two Responses

* - is intent 25 sites versus 5 sites?
- agreed to use five sites; similar to the old criteria
- define profile zones and transition zone
- contact surface in a replaced soil profile
- use standard definitions to describe soil profile

5.15.3 Group Three Responses

* - suggest 40 cm for soil core equipment use
- compaction problems at 50 to 60 cm depth
- up to 50 cm, limit to topsoil and five topsoil samples
- define topsoil transition

- needs tolerances range of values
- Soil Profile Assessment needs further refinement
- maybe compare control to sample (plus or minus)
- what constitutes a failed site?

5.15.4 Group Four Responses

* - needs to be made "field-friendly"

5.16 PLENARY SESSION COMMENTS

Comment.	I don't want to show my bias. It seems to me we have a difference of whether we need both topsoil and surface soil definitions or if we can get by with one. The count is three to one. Some groups have focussed on using the soil horizons very carefully. We did not, we tried to get away from that so there's a difference there. We tried to recognize some of the situations in terms of cultivated, forest, peat, native grassland. I think that's useful and I think not doing that is limiting your applicability. It can be used in situations where you have cultivated soils that are into the subsoil naturally and options are available for taking thicker layers of material in order to have enough to handle or some of those things you wanted. I think it is practical and operational.
Comment.	I'd like to support Group One's proposal. That's a good way of looking at it. There's a different thought process that went on here and it's reasonable because it does go back to this idea of the guy pulling the levers, all he cares about is what's useful soil and what's not or what should be salvaged and what shouldn't be. I don't think it matters what we call it – topsoil or surface soil. Use one definition.
Comment.	I have to point out that there are some possible difficulties for the regulatory agencies in identifying some of the problems he might be having when they go out there to try and certify.
Comment.	I feel that there is one principle that they have to follow when looking at the surface soils. Topsoil is topsoil. So to me, using it in practice I've always talked about topsoil because then you don't have any arguments about whether it's topsoil or not. You have a reason to salvage it and so we will salvage it.
Question.	With Group One's recommendations, it brings back the problem that we were having before when you go to describing surface soil by depth. How to you determine the quality of that upon replacement?
Response.	When you look off-site, you'll see the same material off-site and it will tell you where things are different and that should be your guide as to where you end up. If you're in a cultivated field and have access to rich topsoil or surface soil, you should have that salvaged. If you're in a forested area, we give a specific amount of mineral material to mix with the surface organic.
Comment.	Replacing 80% of 10 cm is pretty difficult, whereas the greater depth of topsoil you have the greater chance of respreading it. I would just say that if there's a choice between either 10 cm and 15 cm, I'd certainly say 15 cm would be a better choice.

Comment. That relates back to the problem I get all the time. Topsoil depth is there. It's just like with the two-tone soils, you get a situation just below the topsoil. You've got to allow yourself to keep that middle material that may be of value as rooting material.

Question. So could you double-strip it and take a second layer?

Response. This is just surface soil.

Question. We've moved from a definition and now we've got situations and I'm wondering how far we're going to go? I was looking for a definition that could be used numerically to help the criteria to work. Is that where we're going with the definition? Are we trying to explore every possibility?

Comment. I'm not sure that you can agree or disagree with the concepts in the definitions until you run through each scenario and see how they've handled different situations in their system.

Comment. A lot of the difficulty in trying to make the definition workable is based on whether the Ae is necessarily valuable. If you get back to Group One's definition, that's talking about soil without having to say every Ae must be recovered and every other thing that we're putting into this definition has to be recovered. Getting back to the end land use, the suitability of this surface lift and again I would support surface lift over surface soil because it's talking about trying to put back the most suitable material in surface lift applications. I believe all the groups are talking about the suitability of the Ae horizon. If you've said Ae in your definition, you all have restricted your ability to do a bit of a judgement call on maintaining the better surface.

Question. Does anyone see a problem in the one or two groups that need 10 holes in the Green Area and forest land sites and how many holes does your group have? Do you have a 30 x 30m grid? Any comment on using pre-assessment information for controls when we do reclamation certification?

Response. I think it's more accurate than off-site.

Response. I think if you have the choice if you have pre-disturbance assessment data and you want to use it at the time of assessment, you should be able to use it.

Question. Does your pre-construction site assessment need to be at that specified density?

Response. No.

Comment. They might say you would have to have a 25 hole pre-set.

Comment. OK. That requires a government decision on whether they will accept that information.

Question. It looks like for situation where the access hasn't been built into a road – where we've used grassland or something to drive into – it seems pointless to sample it. I don't know if we can get agreement on that?

Response. I think all of the groups agreed on that.

6. BREAK-OUT AND PLENARY SESSION: LANDSCAPE CRITERIA

The second break-out group assignment was to discuss the landscape-related criteria. Following the listing of the four technical group responses are comments and feedback presented in the plenary session.

6.1 LANDSCAPE - GENERAL

6.1.1 Group One Responses

* - overall site assessment (not at points)

6.1.2 Group Two Responses

* - ok as is

6.1.3 Group Three Responses

* - off-lease/off-site damage needs to be considered

6.1.4 Group Four Responses

* - Landscape will be assessed by company. Compare the site with the pre-disturbance conditions or adjacent land. Difference between the site and the adjacent land must not interfere with normal land use and not show negative impact on-/off-site.

6.2 LANDSCAPE - DRAINAGE

6.2.1 Group One Responses

* - accept original criteria

6.2.2 Group Two Responses

* - concern with blocking drainage with clay pads, especially in Green Area
- easily remedied by creating a drainage through the blockage

6.2.3 Group Three Responses

* - clay pad issue not to influence drainage

6.2.4 Group Four Responses

* - ok, accept original criteria

6.3 LANDSCAPE - EROSION

6.3.1 Groups One, Two, Three and Four Responses

* - accept original criteria

6.4 LANDSCAPE - CONTOUR

6.4.1 Group One Responses

* - accept original criteria
- add "might improve by levelling"
- edit "exempt" policy for naturally-eroded lands.

6.4.2 Group Two Responses

* - accept original criteria
- move exemption to beginning of landscape criteria

6.4.3 Group Three Responses

* - ok as revised (Appendix K)
- mechanism needed to address contour change
- based on potential land use, if not affecting normal use (i.e., gravel pits)
- vegetation statement to beginning of criteria

6.4.4 Group Four Responses

* - accept original criteria

6.5 LANDSCAPE - STABILITY

6.5.1 Groups One, Two, Three and Four Responses

* - accept original criteria
- five-year liability covers concerns

6.6 LANDSCAPE - COARSE FRAGMENTS

6.6.1 Group One Responses

* - call it gravel, stones/rocks
- gravel 10% +
- stones/rocks <10 cm
- from 0% to 10% is a big increase
- from 20% to 30% is much less obvious

	GRAVEL	ROCKS
Cultivated	some - 5 some - 10	0
Grassland (non-arable)	Public lands: 20 Private lands: 10 - 20	0
Grass now but arable	10	0
Forest	gravel + rocks = 20	gravel + rocks = 20
Treed now but arable (White Area)	10	0
Peat (Green area)	see forest standards	see forest standards

- to increase private and public lands:

	GRAVEL	ROCKS
Cultivated Lands	5	0
Grasslands#	20	0
Forest#	gravel + rocks = 20	gravel + rocks = 20

If potentially arable (CLI 1 to 4), use cultivated standards

6.6.2 Group Two Responses

* - government statement ok (Appendix K)

6.6.3 Group Three Responses

* - private land (cultivated)
    - increase to 20% ≤ 10 cm
    - consistent with volume
- accept revised (three statements) (Appendix K)

6.6.4 Group Four Responses

* - same as soil for private land
- public land: amended proposal (20%)
- Green Area: not needed (except if piled or windrowed in large numbers)

6.7 LANDSCAPE - DEBRIS

6.7.1 Group One Responses

* - no burial (what about cement?)

6.7.2 Group Two Responses

* - add: "woody debris must not interfere with adjacent/normal land use."
- delete: "no" on second point

6.7.3 Group Three Responses

* - ok as is, original criteria
- other suggestions:
    - bury cement 1.2 metres cover on-site.
    - do we create incipient landfills?
    - consider woody debris (small roots and slash) for erosion control
    - trees can be left on-site if fire/management problem does not exist (private lands)
    - should bush or cultivation be used as control?

6.7.4 Group Four Responses

* ok, except where used for erosion control (assume prior agreement)

- if control is bush, why clean up roots and debris? (industry perspective)

6.8 PLENARY SESSION COMMENTS

Question. Do you know the ruling on cement returns? What is government's guideline for disposing of cement on wellsites?

Response. Maybe we can clarify the issue a bit. From our dealings right now with the Energy Resources Conservation Board, cement returns are allowed. They can be left on site as long as it has 1.2 m of cover.

Comment. I think industry will want to think very carefully about any onsite burials and what your alternatives are. If you're thinking of cement burials in cultivated areas, I'm not sure that is such a good idea all the time. We really need to look at the issue more closely, we don't have a lot of regulations for such activity. I know that in Saskatchewan, Sask Energy & Mines won't allow you to bury cement pads onsite.

Comment. As you recall, I don't think burying the cement is something that can negatively affect reclamation. I guess I feel very strongly that I'd like to see that written in, our ability or to retain the ability to do that. On a site-by-site basis I don't see a problem with cement burial or a pump jack pad if the pump jack pad is broken up.

Response. Alberta Environmental Protection has a draft information letter that talks about the recommended depth for burial of materials onsite. As soon as it is approved for distribution, we'll get that information out.

7. BREAK-OUT AND PLENARY SESSION: VEGETATION CRITERIA

The third break-out group assignment was to discuss the vegetation-related criteria. Following the listing of the four technical group responses are comments and feedback presented in the plenary session.

7.1 VEGETATION - PRESENT AT TIME OF ASSESSMENT

7.1.1 Group One Responses

* - present at inspection?
  - yes (or data from previous crop)
  - yes on forest

7.1.2 Group Two Responses

* - whose assessment?
  - industry?
  - government?
- check vegetation growth at intervals throughout growing season
- what about summer fallow conditions?
- opportunities to assess vegetation by independent documentation or inquiry
- opportunities need to be identified

7.1.3 Group Three Responses

* - ok as is, accept original criteria
- can assessment provide enough information for Reclamation Officer to accept if no vegetation present at time of inspection?

7.1.4 Group Four Responses

* - ok as is, accept original criteria except our soil assessment and vegetation during our assessent (industry response)
- soils and chemistry and vegetation (government response)
- agreed: need formal method for vegetation assessment to provide acceptable "historic" information

7.2 VEGETATION - LENGTH OF TIME PRIOR TO ASSESSMENT

7.2.1 Group One Responses

* - established for how long?
- one year on public lands
- one growing season on cultivated land
- forestry position: no consensus
- two seasons without fertilizer (means minimum of three years)
- early application with justification

7.2.2 Group Two Responses

* - Green Area:
    - one year without fertilizer or amendments (industry = yes, government = no)
- comparison to control management practises
- assess on the basis of sustainability or potential sustainability
- interpretation by a qualified individual
- relates to juvenile plants
- must over-winter

7.2.3 Group Three Responses

* - vegetation has to be present (want quicker response)
- 12 months from time of seeding--private land--revised
- point 1: delete all
- point 2: delete "minimum"
  delete "in White Area"
- point 3: delete
- point 4: add "no fertilizer influence."

Summary: all lands - a minimum of a winter survival and one near-complete growing season without effect of fertilizer – fertilizer assumed to be gone after one growing season. Then need to look at how late in season work can be done before discounting fertilizer before assessment certification.

7.2.4 Group Four Responses

* - ok, accept original criteria
- remove "full reconstructed soil" and replace with "rooting"

7.3 VEGETATION - SPECIES COMPOSITION

7.3.1 Group One Responses

* - compatible or meet land management objectives.
    - forest
    - native grassland
    - improved pasture/hay land
- cultivate same crop

7.3.2 Group Two Responses

* - ok as per government statement (Appendix K)
- should be a tolerance for weeds when comparing to adjacent areas

7.3.3 Group Three Responses

* - define "compatible"
- is seed mix compatible?
- who decides compatibility and species issues?
- what about landowner requests, i.e., crested wheat grass?
- land management objectives?

- who decides on private lands, i.e., landowner, Reclamation Inspector?
- how do we measure species composition?
- seed mix does not reflect what is in field
- tolerances
- range/composition
- lack of consultation with landowner regarding grass reseeding/mixtures

7.3.4 Group Four Responses

* - add "or to meet the land management objectives"

7.4 VEGETATION - HEIGHT AND DENSITY

7.4.1 Group One Responses

*
- vigour = health
- measure height (eyeball)
- colour
- disease
- crop quality
- crop yield

7.4.2 Group Two Responses

* - ok, accept government statement (Appendix K)

7.4.3 Group Three Responses

*
- rooting to be assessed in Soil Profile Assessment
- need better information regarding criteria, i.e., colour, disease, crop quality
- what fails a site?
- is vigour a part of landscape?
- vigour is important for Green Area
- height was good as part of cereal and only possible reason or some crops
- density (cereal and grasses)
- yield/productivity measures?

7.4.4 Group Four Responses

* - accept amended government proposal (Appendix K)

7.5 VEGETATION - COVER

7.5.1 Group One Responses

*
- 80% of adjacent
- 40% for erosion control
- measures:
    - eyeball
    - triangle
- includes litter (but no more than control)

7.5.2 Group Two Responses

* - accept revised government statement (Appendix K)

7.5.3 Group Three Responses

* - achieve 80% adjacent, except where adjacent is $\leq$ 40%, then achieve 100%

7.5.4 Group Four Responses

*
- if controlling vegetation $\leq$ 40%, site should be 100% of control (industry view)
- want 40% minimum for erosion control (government view)
- add: "naturally occurring"
- litter can be included
- use PFRA standard (70% of adjacent?)

7.6 VEGETATION - ROOTING

7.6.1 Groups One, Two, Three and Four Responses

* - accept use of Soil Profile Assessment (Appendix K) and vigour

7.7 VEGETATION - BARE AREAS

7.7.1 Group One Responses

*
- ok, accept original criteria
- gas migration problem
- Level 2 "guidelines" useful for Level 1 and for guiding "further investigation"
- don't need Level 2 to fail a site

7.7.2 Group Two Responses

* - accept revised critieria (Appendix K)

7.7.3 Group Three Responses

*
- ok as is, accept original criteria
- no bare areas around well centre

7.7.4 Group Four Responses

* - accept original criteria

7.8 PLENARY SESSION COMMENTS

Comment. We found that if you're going to use the previous year's growth that there has to be some standard way of evaluating that through documentation or other information already in place and those should be investigated for that purpose.

Comment. In our group, we felt that it was far more positive if in our assessment we could provide vegetation information so that the Reclamation Inspector would be able to complete the assessment on a first visit to the wellsite.

Comment. I just have one general comment. In going through the topsoil and landscape criteria, a lot of people are saying – "drop admixing . . . drop layering . . ."and leave out some other things. Then when we go into vegetation, I start hearing something like we want a quick and dirty way to assess vegetation, we don't want to wait 1 or 2 years to have certification. If you're going to start giving up parameters like admixing and layering, you better be prepared to wait 1 or 2 years for vegetation because I would then see a lot more emphasis on using vegetation as more of a criteria in the future. There has to be some give – if you want to give up on topsoil parameters, you've got to be ready to accept maybe 1 or 2 years to assess a site.

Comment. Well, we have got a 5-year liability after certification.

Response. There's a problem using the 5-year liability as an excuse to certify something. You say this isn't quite right but well we'll leave that to the 5-year liability. I don't think you can do that. It's got to pass/fail to the criteria. You shouldn't be saying we'll leave it because it has a 5-year liability.

Comment. With certification, you've got the lease payment stopped so all you're paying now is damage during the 5-year liability time frame. Is the question whether you're concerned about paying the compensation for that time that you wanted 1 year rather than 2 or 3 or is it really a matter of the success of the crop. If it's a compensation thing I think Larry has said that he's going to try and resolve it.

Brocke. We want to wait and look at things then that are strictly a compensation issue and what we want to do is put forward an amendment to the Act to deal with that, in effect getting rid of that section in the Act that links issuing a reclamation certificate to cancelling the surface lease. I'm not guaranteeing that that's going to go through. We've had discussions with the Surface Rights Board, and they have indicated they won't have any difficulty with us taking that out of the legislation.

Comment. So, in order to help the people who are going to put this document together, is it a vegetation success issue or is it truly a compensation issue. Maybe the criteria needs to say it.

Comment. It's not a good reason to continue to pay the lease payment, it's a good reason for the operator to continue to pay damage but not for the lease and damage.

Comment. I'm talking a situation where we want to put a lot more emphasis on vegetation as a single criteria for a pass/fail and in a situation, for example, a cultivated field where crop has been seeded andis just emerging out of the ground, you may have a soil contaminant down 20 to 30 cm. The roots haven't had enough time to develop into where that contaminant is. You go on site, vegetation looks great, we're using that as a yes/no,. Yes it's looking good but you go there 3 months later and the vegetation will die as the roots have descended into that contaminated area. I'm saying that's the problem I can foresee if we put more emphasis on vegetation yet we will want to get quick certification.

Question. You're talking cereal crops only?

Response. On anything.

Comment. What I'm saying is you take away parameters that will give you the ability to look in there and maybe find that contaminant. You take that away and say we'll put more emphasis on vegetation as yes/no, if you take away the front end of it where it gives the ability to dig in there and find it, then you may miss it.

Comment. I think what Jeff is trying to say is what Larry said earlier today about using vegetation to identify a capability. If we start taking more away from the soil, then we've got to put more on using vegetation for capability and you have to assess that over a longer period of time.

8. POLICY/ISSUES GROUP REPORT

(Presented by Mr. Gary Webster, Canadian Association of Petroleum Producers)

The following discussion points were made in the policy/issues group during Day 1 of the Wellsite Reclamation Criteria workshop:

- Wellsite criteria and reclamation policy must deal with post-1993 site development and existing sites, regardless of age.
- New sites require: pre-site assessment, development of good construction work practices.
- Need to consider training needs for assessment and for construction practices.
- Must address the following: How the concept of leases, which don't meet targets but have extenuating circumstances (i.e., common sense, can result in a Reclamation Certificate being issued, and how that will play to the public.
- All operators have option to go to other processes which prove capability if they don't pass the criteria document: e.g., Leskiw land capability approach is acceptable, but it must be remembered that the Reclamation Inspectors are currently not trained to assess wellsites using such a system and may the Leskiw approach may also require some chemical analysis. Any option still requires vegetation capability assessment.
- Alberta Environmental Protection advises they want serious applications – they don't consult for the operator and they are seriously considering significant fees to visit a lease after the second visit.
- Alberta Environmental Protection advise they intend to reactivate the Lease Reclamation Committee to work out many of the policy and probably some of the technical issues raised at this workshop as well as those issues which will arise as a result of future field experience with the criteria. This committee will also deal with those leases which cannot be reclaimed without significant cost.
- Some of the issues may be resolved by Alberta Environmental Protection issuing a Reclamation Certificate with conditions. Government doesn't intend this to be routine. It might allow long-term arrangements. The process would have to be developed.
- Professional judgment/objectivity/flexibility are very much a site-specific issue. Industry professionals need to work with Reclamation Inspectors to develop mutual understanding of ranges of judgment. Industry wants the logic of decision-making defined and documented, where possible.
- Company should make every effort to be present on lease when the Reclamation Inspector visits the lease for the certificate review meeting with the landowner. This is particularly necessary where there may be a "no, but . . ." issue in the application.
- Reclamation Inspectors have a responsibility to document reasons why a site may not be granted a Reclamation Certificate, e.g., locations and details on sampling program and description of why views differ from those of the applicant – at the same level of detail.
- Goal is to ensure this process is efficient and prevents the generation of orphan sites.

The following are my (Gary Webster) personal concerns and don't necessarily reflect the concerns of the rest of the folks in the policy issues group:

First concern:	The process has narrowed the understanding and agreement gap – we still need to jointly work to further reduce the gap.
Second concern:	Still not dealing with the chemically-contaminated sites.
Third concern:	What actually can be achieved in winter construction of leases?
Fourth concern:	The professionals at this workshop represent 80% of the construction industry and are setting the construction performance standards. We request Alberta Environmental Protection focus compliance on the other 20% of the industry.

(Summary Observations by Mr. Rob Staniland, Talisman Energy)

The following comments were prepared by Mr. Rob Staniland of Talisman Energy. These statements are based on his personal observations and recording of discussion items during the two days of meeting with the policy/issue group. These responses do not necessarily reflect the views of all policy/issue group members:

- What do we do with "unfixable" problems (significantly reduced capacity, with no potentially highly effective fix, short of major soil replacement). What alternative compensation mechanisms might be developed (none possible now).

- Topsoil replacement issue. Industry believes that borrowing topsoil makes no environmental sense. Suitable material (from permanent land use changes) will be available in very limited quantities and borrow from otherwise productive land will have a net negative environmental result.

- Government indicated a need to see that an adequate search was made to find:
  - all topsoil stockpiles associated with the lease
  - locally-available deposits of blown or eroded topsoil (i.e., along fences or ditches)

  Industry calls these potential "textural" amendments.

- The Leskiw capability system was discussed.
  - Could be used as a Level II assessment, but Government anticipates it will require more field and analytical work than proposed criteria, so why would industry pursue?
  - Goverment people are not trained-up for it, and have not determined acceptable instances within the system for its use as criteria.
  - Industry may want to build a data base of this system's "capability" classification compared with actual site/vegetation response.

- Original derivation of soil quality numbers addressed the potential cumulative effect of net topsoil loss, distribution problems and admixture (government). Industry was unsure of the validity of that logic when considering parameters individually.

9. WORKSHOP CLOSING REMARKS

9.1 GOVERNMENT PERSPECTIVE: FUTURE DIRECTION

(Presented by Mr. Larry Brocke, Alberta Environmental Protection)

Just a few comments to indicate where we need to go from here. We hope to have a final report in the next month or so. I guess the wondering is what are we going to do with it from there? We will need to thoroughly review that information and what I would like to see is that a small working group – small probably means six people – three industry and three government, and lock them in a room together until they redraft the thing taking into consideration all of the comments.

We would like to have a new draft of the criteria document before April 1994. That will be our criteria for use starting with this 1994 field season, hopefully. That is not to say, and I want to emphasize again, that does not mean that it's finished, we're still going to run into things over time. There will be a continual need to upgrade this criteria document. Everybody should recognize that and use it with that in mind. If you can accept that, you set aside your fears of using it and submitting applications based on the document.

Along with the workload that we have from today forward we have a backlog to deal with. I'm not going to say a lot about the backlog other than to say for us in Environmental Protection alone and I haven't talked to the public lands people about any backlog they might have on certificate applications, but just Environmental Protection dealing on private lands, there is somewhere in the neighborhood of 3,500 applications in abeyance for one reason or another. It's 3,500 - works out to somewhere in the neighborhood of half of those are company responsibility and half of them are ours to deal with. I have a commitment from above that we're going to deal with them in the next year or two. We have to have this package to make that go and there's just no other way. We're committed to it, I hope you are.

In reference to Ian's suggestion yesterday about a wellsite reclamation steering committee. There is one, it simply hasn't been active for a couple of years. I want to reinstitute that. I think what it would parallel would be the pipeline environmental steering committee. It would have the same kind of membership, the same kind of tasks, it would be used to vent issues that might come out of the criteria package that still need to be worked on.

Training is going to be exceptionally important, I think. The criteria package can be refined, and upgraded. But there's another thing we talked about that comes under the general auspices of training and that is I think strictly technology transfer if you like. Getting the guy on the machine to understand what the criteria are about. That's a transfer thing and I think that's probably the kind of a task that the Industry could take on and ensure that happens. You folks here or that work with the criteria have a responsibility for the equipment people to know that their actions affect what happens to you in applying the criteria. That's very important as well.

I'm surprised none of the groups brought it up but probably because it wasn't in the document and that is winter construction. In our group we spent a little bit of time talking about it from an overall approach basis rather than anything else. I think everybody accepts that and recognizes that winter construction will be with us. An option is not to say that there won't be winter construction. I don't think any of us are prepared to put that forward. I think what we were in agreement on was that the approach in dealing with winter construction has to be that the intent of the criteria to obtain certification is there no matter whether you're building it in winter, summer, fall, spring, midnight or 6 in the morning. The intent of the criteria is there.

Secondly I think we recognize the difficulty and we have to acknowledge the need, at times, to use some mitigation program. I think Len talked about that for other issues, I think it applies here as well or a management program of some kind. If you can't meet the criteria, there is the "no, but . . ." to deal with winter construction and getting yourself to meet the intent of the criteria. We believe that this is reasonable and it should continue to be an option and I guess one of the first jobs of this new wellsite environmental steering committee would be to define some terms of reference of how we're going to go about working out what are some reasonable approaches for this.

Industry has shown us in the past when they run up against a construction difficulty whether it's to do with wellsites but in particular what comes to mind is pipelines and winter construction, the innovativeness that comes forward will show that they will develop some techniques that can serve what you need to have. We need to encourage that, it's been demonstrated over and over.

I would certainly like to commend everybody for your exceptional efforts in the last two days before and what's coming up. This is going to be well worth it and make everybody's job just a little more pleasant.

9.2 INDUSTRY PERSPECTIVE: FUTURE DIRECTION

(Presented by Mr. Gary Webster, Canadian Association of Petroleum Producers)

I think it's fair to say that Industry is interested in making sure that we deal with poor operators and I think we have CAPP's commitment to work with the department and public lands to help develop these training programs. We'll look forward to your cooperation there as well.

I would like to thank all of the participants for their positive approach and particularly the department for their commitment to developing a workable guide. This workable guide that we're going to come out with is going to help eliminate your backlog and it's also I think going to set up an approach that we can encourage those companies that have their wells suspended to now get into the business of actually reclaiming the lease and abandoning the wells and reclaiming them because of increased certainty in the process.

I'd like to thank Chris Powter and David Lloyd and Larry Brocke because I gave them a challenge back in December. I said how are we going to get well prepared for this and I'd like to thank all of you for having all your Reclamation Inspectors and your staff so well prepared. I think because you are well prepared and our people had that for their homework as well, this workshop was a real success. This workshop has been phenomenal. I think it's very helpful.

I've heard a lot in my observations and I think everybody else has too. I'm still concerned about how we're going to review the success and failure rates in the summer of 1994 and the 1993 results but I hope the concerted effort by both government and industry folks to establish how the success of the application of the reclamation targets can be entertained in the industry.

If there's some value in having Rob Staniland take the results of the pass/fail or the fail/but analysis that you put together, I think maybe Rob that that would really help with the process. I'm much more positive and I sense we collectively have a much more positive story to tell now. My concern when we came into this that we were finding reasons to fail leases. Now our position is finding the reasons to pass them and clearly explain to the landowner and the public what process we go through because ultimately the biggest sales job is going to be the landowner and the public. If we haven't got a good news story, we're going to have nothing but hassles and appeals. I think that as a result of the way we've done it today, we've got a better-news story than we had when we came in.

We also seem to have a more integrated approach that will be easier for the public to understand. One of the things that I stressed to our Industry pre-meeting attendees was that I did not want to hear the "e" word, the exemption word and I'm pleased to hear that I didn't hear it and my friend Len says that when it did come up in their group, they threw it out because an exemption is a no sale for political reasons. I'm really pleased that you were able to do that. So my final word is that this is a challenge to all of us here on how we're going to take the results of this workshop, how we're going to resolve the still little bit that we're apart, and how we're going to see the results of these field reclamation and certification performances for the fall and over the later part of the summer. Thanks for coming.

APPENDIX 'A'

INFORMATION LETTER:
RECLAMATION CRITERIA FOR WELLSITES AND ASSOCIATED FACILITIES

Alberta Land Conservation and Reclamation Council

LCRC/IL/93-2

INFORMATION LETTER

Reclamation Criteria for Wellsites and Associated Facilities

Application

Oil and gas wellsites and associated facilities such as borrow pits, campsites, and off-site sumps.

Background

This package consists of three parts:

- Conservation and Reclamation Code of Practice for Surface Disturbing Activities in Alberta;
- Reclamation Certification Criteria for Wellsites and Associated Facilities; and
- Wellsite Reclamation Certificate Application Form.

The package was developed by the Conservation and Reclamation Council based on its 30 years of experience in wellsite certification and has been reviewed by industry and other major stakeholders. Two stakeholder meetings were held in March and April, 1993, to present and discuss the criteria package. Changes were made as a result of those two meetings and are incorporated into these working documents.

The attached package will be used this field season on a trial basis to determine if the reclamation criteria accurately define a site that is ready for certification. The trial period will also determine if the assessments necessary to evaluate the criteria are workable in the field.

To ensure that both industry and government staff are applying the criteria in the same manner, and to promote familiarity with the criteria, a series of courses are being offered by the Petroleum Industry Training Service this spring. The courses will cover the principles of the criteria in a classroom setting and will include field evaluations. Further courses will be offered next spring after the criteria are finalized.

Code of Practice

The Code replaces the 1982 "Minimum Reclamation Requirements for Public and Private Lands in Alberta". It promotes and encourages environmental awareness and planning. The Code outlines some specific factors to consider in project planning, site preparation and operation, reclamation and monitoring.

Reclamation Criteria

The fundamental principle of the criteria is that any changes caused by project activities should be measured against the original or representative site conditions.

The certification criteria describe the allowable changes in site conditions (landscape, soil and vegetation) that will still maintain equivalent land capability. They account for the various legislated topsoil salvage and replacement rules by setting soil depth targets depending on the date of construction.

The criteria apply to wellsite leases, access roads, and off-site borrow pits, sumps, and campsites. They do not apply to facilities that are left in place (e.g., roads, pads, dugouts, etc.) with the landowners approval.

The document is divided into two sections:

- Level I - certification criteria; and
- Level II - problem identification and characterization.

Level I criteria will be used to judge reclamation success and grant the reclamation certificate. The operator must supply information relative to the criteria on the Wellsite Reclamation Certificate Application form. In Level I, field assessments are used, rather than laboratory data; however, sampling and laboratory analyses should be undertaken when problems are apparent, or when spills have occurred or sterilants have been used.

Level II will be used to help identify and characterize problem areas that require further reclamation prior to application for certification. These characteristics will not be used to determine certification; however, if a problem is identified, the Conservation and Reclamation Council may require you to evaluate any or all of these characteristics. You may also be required to provide data for the landscape, soil or vegetation criteria in Level I or any other environmental factors.

Reclamation Certificate Application Form

The form was developed to ensure the site was ready for certification and speed the review of applications. The form has five parts:

- General information about the operator and the facility location and type;
- Site history, including dates of significant activities, and information on spills, herbicides/sterilants, fertilizers, soil amendments, underground facilities, and improvements;
- Site data based on the requirements in the Reclamation Criteria;

May, 1993

- Information regarding the final inspection by the company and their desire to be involved at the inquiry; and
- A declaration, which an official of the licensed operator must sign, indicating that all the information provided is accurate.

The operator must provide a copy of the certificate of title (for private land) and survey plans of the wellsite and the area immediately adjacent to it. A diagram of the wellsite during construction, and if applicable, during operation, is also required.

Implementation

- The draft criteria are to be tested for the 1993 field season. The results of the trial period will be reviewed with stakeholders in the winter and a final set of criteria will be established for use from 1994.
- Inquiries conducted in 1993 will utilize the new draft criteria for assessment purposes, however issuance of reclamation certificates will be based on the old criteria.
- We will provide industry with initial copies of the Application Form. Industry is expected to make their own copies when the initial supply runs out.
- Industry is strongly encouraged to use the draft criteria prior to assessing their sites in 1993 and to submit their applications for certificates on the new Wellsite Reclamation Certificate Application Form. The data on the forms will help in the criteria review this winter. A sample completed copy (minus the certificate of title and survey) is attached to this Information Letter.
- Comments on the criteria or the form should be sent to Larry Brocke, Chairman, Conservation and Reclamation Council, Alberta Environmental Protection, 3rd Floor, 9820 - 106 Street, EDMONTON, Alberta T5K 2J6.
- The Conservation and Reclamation Council recognizes that the Site History information that is required on the form may not be available for all old wellsites. The Council strongly encourages industry to obtain as much of the information as possible. This will reduce the need for in-depth field assessments of potential problem sites. For sites constructed after May, 1993, all the Site History information must be provided for the application to be accepted.
- Reclamation officers will also be using the new criteria and the form to collect data on older sites this year. This will increase the database for the winter discussions.
- The topsoil quality assessment is to be done to a depth equal to the expected replacement depth. Thus, for a control topsoil depth of 10 cm: a site constructed in 1993 would have topsoil quality assessed in the upper 9 cm at each sample location; a site constructed in 1985 would have topsoil quality assessed in the upper 8 cm at each sample location; a site constructed in 1962 on CLI Class 3 land would have topsoil quality assessed in the upper 7 cm at each sample location; and a site constructed in 1962 on CLI Class 6 land would have topsoil quality assessed in the upper 5 cm at each sample location.

Conclusions

- The criteria have undergone extensive review by stakeholder groups and will continue to be reviewed during the 1993 field season prior to development of a final version.
- The criteria clearly set out the expectations of reclamation and the methods that will be used to measure success.
- The criteria are based on the experience of the Conservation and Reclamation Council and Alberta-based reference documents.
- The criteria retain flexibility in recognition of the variable nature of the environment.

Further Information

For more information contact

- Chairman, Conservation and Reclamation Council, Alberta Environmental Protection, 3rd Floor, 9820 - 106 Street, EDMONTON, Alberta T5K 2J6.
- Deputy Chairman, Conservation and Reclamation Council, Alberta Agriculture, Food and Rural Development, 2nd Floor, J.G. O'Donoghue Bldg., 7000 - 113 Street, EDMONTON, Alberta T6H 5T6.
- Deputy Chairman, Conservation and Reclamation Council, Alberta Environmental Protection, Land and Forest Services, 5th Floor, 9920 - 108 Street, EDMONTON, Alberta T5K 2M4.
- Your regional reclamation officer.

APPENDIX 'B'

CONSERVATION AND RECLAMATION CODE OF PRACTICE FOR ALBERTA

CONSERVATION AND RECLAMATION CODE OF PRACTICE FOR ALBERTA

The Code updates the 1982 "Minimum Reclamation Requirements for Public and Private Lands in Alberta". It outlines factors you should consider if you are not required to obtain a Conservation and Reclamation Approval.

For more detailed information contact Reclamation Officers in Alberta Environmental Protection.

The Code promotes and encourages:

1. The return of a disturbed site to a land capability equivalent to the pre-disturbance land capability. This capability must be sustainable under normal management.
2. Acceptance of pre-development soil, landscape and vegetation conditions as the standard for post-development conditions.
3. Identification of potential soil, landscape and vegetation conservation concerns through pre-construction site assessments and pre-planning.
4. Conservation of the essential characteristics of the project site (e.g., soil, landscape, vegetation) to minimize post-construction remedial requirements.
5. Awareness of the value of soil, the sensitivity of soil to disturbance, and the difficulty of reclaiming degraded soils.
6. Awareness of the importance of the native vegetation on a project site, and the need for protection and rapid reestablishment of vegetation that is compatible with the adjacent land.
7. Monitoring all activities to ensure a complete record of conservation, degradation, mitigation and reclamation events.
8. On-site supervision of development and reclamation activities by personnel responsible for environmental quality control.
9. Reclamation on as much of the disturbed area as possible each year to minimize land disturbance.
10. Site assessments following reclamation which provide a complete evaluation of soil, landscape and vegetation conditions and compare them to pre-development conditions, prior to application for a reclamation certificate.

[1993 WORKING DOCUMENT - April 1993]

SPECIFIC FACTORS TO CONSIDER

Project Planning

- **Communication** - Communicate with the landowner, occupant and Conservation and Reclamation Council from the start to the finish of the project.
- **Location** - Locate site to minimize impact on resources (e.g., soil, vegetation, water and wildlife).
- **Planning** - Develop plans for conservation, reclamation, and waste handling and disposal.
- **Timing** - Time operations considering climatic, soil, vegetation and wildlife concerns.

Site Preparation and Operation

- **Disturbance** - Keep all disturbances to a minimum. Obtain approval from Alberta Environmental Protection for disturbances on public land.
- **Soil** - Properly salvage and store materials. Keep an accurate record of storage locations.
- **Waste** - Put contaminant spill contingency measures in place before operations commence. Dispose of all wastes in an approved manner.
- **Access** - Put all necessary gates, fences and authorized access in place with clear signage.

Reclamation

- **Contamination** - Cleanup and dispose of, or remediate, contaminants to meet Alberta Environmental Protection requirements.
- **Landscape** - Recontour the site to original grade and drainage. Control erosion.
- **Soil Replacement** - Replace soils in same sequence as found before disturbance unless otherwise directed by the Conservation and Reclamation Council.
- **Compaction** - Correct soil compaction.
- **Revegetation** - Use approved revegetation species that are compatible with the intended land use. Control noxious weeds.

Monitoring

- **Sustainability** - Ensure land capability is sustainable under normal management.

Reclamation Certificate

The Alberta Environmental Protection and Enhancement Act requires you to reclaim land and to obtain a reclamation certificate. Refer to the appropriate Reclamation Certificate Application form and criteria for the information required when applying for a certificate. Ensure that all site conditions (landscape, soil, vegetation) meet the required criteria before requesting a certificate.

APPENDIX 'C'

RECLAMATION CRITERIA FOR WELLSITES AND ASSOCIATED FACILITIES

RECLAMATION CRITERIA FOR WELLSITES AND ASSOCIATED FACILITIES

The fundamental principle of these criteria is that any changes caused by project activities should be measured against the original or representative site conditions. In most cases, the land, soil and vegetation adjacent to your site will be used as a comparison. However, in special cases, you may have to find representative land, soil and vegetation a short distance from your site; your reasons for doing this must be explained to the Conservation and Reclamation Council at the inquiry.

The document is divided into two sections:

- Level I - certification criteria; and
- Level II - problem identification and characterization.

The certification criteria describe the allowable changes in site conditions that will still maintain equivalent capability.

Drilling wastes and other oilfield wastes must be properly disposed of according to Energy Resources Conservation Board guidelines. All contamination must be treated prior to certification. Specific criteria for the assessment and remediation of contaminants (e.g., metals, sterilants, organic chemicals) will be provided by Alberta Environmental Protection.

The certification criteria apply to wellsite leases, access roads, and off-site borrow pits, sumps, and campsites. They do not apply to facilities that are left in place (e.g., roads, pads, dugouts, etc.) with the landowners approval.

When the reclamation officers inspect your site for certification they will be confirming the information you supplied. *If problems are noted, subsequent requests for site inspections will receive lower priority than first time requests, therefore it is to your advantage to ensure that a site is ready for certification before submitting an application.*

These criteria combine Conservation and Reclamation Council field experience and published documents. The latter include Soil Quality Criteria Relative to Disturbance and Reclamation (Alberta Agriculture, 1987), Land Capability Classification For Arable Agriculture in Alberta (Alberta Agriculture, 1987), reports from the Alberta Soils Advisory Committee and the Reclamation Research Technical Advisory Committee, existing government handbooks and guidelines, and textbooks.

1. LEVEL I - CERTIFICATION CRITERIA

Level I criteria will be used to judge reclamation success and grant the reclamation certificate. You must supply information relative to the criteria on the Wellsite Reclamation Certificate Application form. In Level I, field assessments are used, rather than laboratory data; however, you should undertake sampling and laboratory analyses when problems are apparent, or when spills have occurred or sterilants have been used.

1.1 LANDSCAPE

Landscape criteria will be assessed by comparing the site with the pre-disturbance conditions or adjacent land. Differences between the site and the adjacent land must not interfere with normal land use.

DRAINAGE	• Site drainage should be consistent with the original patterns, direction and capacity or compatible with the surrounding landscape.
EROSION	• No more erosion gullies or blowouts than on adjacent land allowed.
CONTOUR	• Contour and roughness must conform and blend with adjacent contours. • Older, well-vegetated and stabilized sites may be exempt from this requirement. Authorization from the Conservation and Reclamation Council must be obtained.
STABILITY	• No visible evidence of slope movement, slumping, subsidence, or tension cracks allowed.

COARSE FRAGMENTS (Gravel, stone, rock)	• Private Land
	  • ≤10 cm in diameter - an increase of 10% in surface cover (for example, if the control has 5% cover your site may have up to 15% cover).
	  • >10 cm in diameter - 0% increase in surface cover.
	• Public Land - an increase of 10% in surface cover.

DEBRIS

- No industrial or domestic debris allowed.
- No woody debris (roots, slash) allowed unless previously authorized by the Conservation and Reclamation Council.

1.2. TOPSOIL/SURFACE SOIL

For private land and cultivated public land, "topsoil" is defined as all "A" horizon (Ah, Ahe, Ae, and Ap) material within the soil profile. Ae or AB horizons will have to be salvaged with the topsoil or separately salvaged (as a second lift). When the Ae or AB horizons are salvaged with the topsoil, the control for the quality comparison must be a mix of the topsoil and the Ae or AB horizons.

Organic soils and soil layers will also be salvaged and replaced. Shallow organic layers (≤15 cm; L-F-H layers) will be incorporated with the topsoil. Deeper organic layers will be assessed to a maximum depth of 40 cm.

Quantity and quality of replaced topsoil will be assessed on a 20 m x 20 m grid, inset 5 m from the lease boundaries (approximately 25 locations per hectare) on the disturbed area. The individual assessment points must be representative of the 20 m x 20 m block they are in. On access roads, one paired location (an on-road sample and off-road control) must be assessed every 30 m. Highly diverse landscapes will require more assessment locations.

For non-cultivated public land, "surface soil" will be defined as a specific depth of soil to be salvaged and replaced. Depth of replaced surface soil will be assessed on a 20 m x 20 m grid, inset 5 m from the lease boundaries (approximately 25 locations per hectare) on the disturbed area. The individual assessment points must be representative of the 20 m x 20 m block they are in. On access roads, one paired location must be assessed every 250 m. Highly diverse landscapes will require more assessment locations.

The topsoil/surface soil depth criteria take into account the various legislated soil salvage and replacement requirements that have been in effect at different times. In some cases, you may have salvaged topsoil/surface soil when you were not required to; you are encouraged to replace these materials over your site.

A minimum of four control sites (one on each side of the disturbed area) must be assessed to provide comparisons for the disturbed area; more control sites will provide a better assessment of the natural variability in the undisturbed soils. On access roads, control sites (off the road) will be assessed at the same locations as the access road is assessed. Where control site characteristics vary significantly, you should not use the average values for your comparisons; rather, you should use each control to represent a portion of the site or access road.

TOPSOIL/ SURFACE SOIL QUANTITY

Private Land and Cultivated Public Land

- Average replaced topsoil depth must be:
  - 90% of control for sites constructed in 1993 or later;
  - 80% of control for sites constructed from 1983 to 1992;
  - 70% of control for sites in CLI[*] Class 1 to 4 lands constructed prior to 1983;
  - 50% of control for CLI[*] Class 5 and 6 lands constructed prior to 1983.

  [*] CLI refers to the Canada Land Inventory and, in this case, focuses only on the soil capability. It does not include the climate or landscape limitations.
- 90% of the assessment sample sites must be ≥80% of the average replaced depth on the site.
- 100% of the assessment sample sites must be ≥50% of the average replaced depth on the site.
- No assessment sample site with less than 80% of the average replaced depth may be adjacent to another assessment sample site with less than 80% of the average replaced depth.

Non-cultivated Public Land

- Average replaced surface soil depth must be ≥70% of the depth stated in the disposition or the depth specified in writing by the Conservation and Reclamation Council.

TOPSOIL QUALITY

Private Land and Cultivated Public Land

- When compared side by side with representative control samples from similar depths under similar light and moisture conditions, the assessment point samples must be in the same class as the controls as defined below. Improvements in the soil quality class are acceptable.
  - % admixing of subsoil (no more than 20% more subsoil in the sample than in the control). Note: drilling wastes are generally not acceptable in topsoil because soil quality problems have been identified in the past and because we do not have a good understanding of the long term effects on soil quality. However, some waste types in some soil types may be appropriate provided the waste plus subsoil meets the admixing criteria and all the other topsoil quality criteria.
  - texture (classes - see Figure 1).
  - aggregate size (classes - <2 cm; 2 cm to 5 cm; >5 cm to 10 cm). Note: no aggregates greater than 10 cm are allowed unless similar size aggregates are present in the control soil. No pulverised soil is allowed.
  - aggregate strength (classes - friable, firm, hard).
  - layering (classes - no difference in extent; evident difference in extent; obvious difference in extent).
- Each of the parameters is assessed at each assessment point. The assessment point passes only when all the criteria are met. The site passes only when all the assessment points pass.
- When most or all of the topsoil depth is made up through the use of amendments, the topsoil quality criteria may be waived. All amendments must be approved by the Conservation and Reclamation Council.

SALINITY

- No increase in visible salts.

COARSE FRAGMENTS (gravel, stones, rocks)

- Private Land
  - ≤10 cm in diameter - an increase of 10% (by volume).
  - >10 cm in diameter - 0% increase (by volume).
- Public Land - an increase of 10% (by volume).

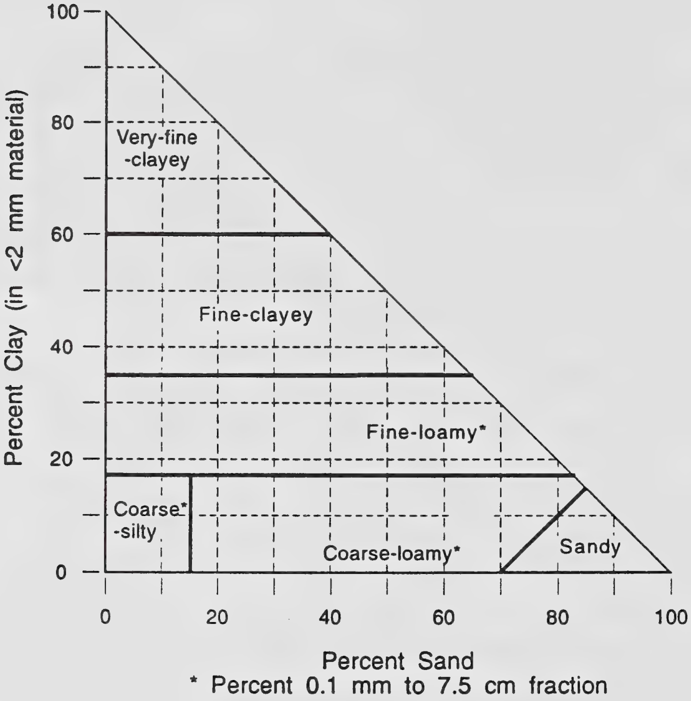

Figure 1. Texture classes

LRHow2.cdr

COMPACTNESS	• Use a shovel, screwdriver, or penetrometer to assess compactness. • Maintain or improve the quality of the following ratings: • Non-compacted - penetrates easily; • Moderately compacted - penetrates with moderate effort; • Very compacted - penetrates with difficulty.

1.3. SUBSOIL

Subsoil will be evaluated at a minimum of five locations to a depth of 70 cm from the soil surface. On the lease, the locations must include excavated or intensively used areas such as the sump, well centre, flare pit, access road entry point, and tank area, if present. On the access road, randomly select five of the topsoil assessment locations. Subsoil samples will be compared to control samples from the same depth.

SALINITY	• No increase in visible salts.
COARSE FRAGMENTS (gravel, stones, rocks)	• Private Land - an increase of 10% (by volume). • Public Land - an increase of 10% (by volume).
COMPACTNESS	• Use a shovel, screwdriver, or penetrometer to assess compactness. • Maintain or improve the quality of the following ratings: • Non-compacted - penetrates easily; • Moderately compacted - penetrates with moderate effort; • Very compacted - penetrates with difficulty.

1.4. VEGETATION

Private land sites will not be certified without vegetation unless you provide detailed soil physical and chemistry data (Level II assessment) or vegetation performance information from previous years. Public land sites will not be certified without vegetation. In the case of producing wellsites where sterilants have been used, or where spills (hydrocarbon, salt) have occurred, vegetation which meets the criteria below must be present at the time of certification. Contact the Conservation and Reclamation Council to determine how long vegetation must grow on the site before you can apply for a certificate.

Reclaimed sites should not require any additional or special management in comparison to adjacent or representative lands to be sustainable or to provide similar crop yields.

SPECIES COMPOSITION	• Revegetation species and species composition should be compatible with original or adjacent vegetation.
VIGOUR	• Plant vigour should be similar to original or adjacent vegetation.
HEIGHT and DENSITY	• ≥80% of adjacent growth[*] based on a visual assessment.
COVER[‡]	• Where the adjacent vegetation is similar, ≥80% of adjacent ground cover based on a visual assessment. Note: for erosion control purposes, there must be a minimum of 40% ground cover on the site. • Where there is no adjacent vegetation or the adjacent vegetation is different, ≥80% ground cover based on a visual assessment unless otherwise authorized by the Conservation and Reclamation Council in writing. • Litter can be included in the ground cover assessment. • The required cover must be evenly distributed on the site.
ROOTING	• No obvious rooting restrictions (e.g., reduced root length, root mats, compressed roots, roots along the cracks only, no roots) in topsoil or subsoil.
BARE AREAS	• Frequency and extent of bare areas should not be greater than original or adjacent vegetation.

[*] Use when crop/vegetation on the site is the same as that surrounding the site. When the crops/vegetation are different, use vigour only.

[‡] Does not apply to annual crops. Density is a better measure.

2. LEVEL II - PROBLEM IDENTIFICATION AND CHARACTERIZATION

Level II will be used to help identify and characterize problem areas that require further reclamation prior to application for certification. *These characteristics will not be used to determine certification;* however, if a problem is identified, the Conservation and Reclamation Council may require you to evaluate any or all of these characteristics. *You may also be required to provide data for the landscape, soil or vegetation criteria in Level I or any other environmental factors.*

2.1 LANDSCAPE

SLOPES
- Final slope gradients must not exceed the original slope gradients by more than 20%.

EROSION
- The rate of erosion on the site must not exceed the off-site rate.

2.2 SOIL

In the Level II assessment, the subsoil must be evaluated to a minimum depth of 100 cm from the soil surface. More sampling locations may be required for both topsoil (surface soil) and for subsoil.

ORGANIC MATTER
- Organic matter content (in percent) must be at least 80% of the control value.

CHEMISTRY
- Soil pH, salinity and sodicity must be consistent with original or representative land. There should be no negative change in rating (Good, Fair, Poor, Unsuitable).

White Area

	GOOD	FAIR	POOR	UNSUITABLE
pH	6.5 to 7.5	5.5 to 6.4 or 7.6 to 8.4	4.5 to 5.4 or 8.5 to 9.0	<4.5 or >9.0
Salinity	**Topsoil** <2	2 to 4	4 to 8	>8
(EC dS/m)	**Subsoil** <3	3 to 5	5 to 10	>10

Sodicity (SAR)	<4	4 to 8	8 to 12	>12

Green Area

	GOOD	FAIR	POOR	UNSUITABLE
pH	5.0 to 6.5	4.0 to 5.0 or 6.5 to 7.5	3.5 to 4.0 or 7.5 to 9.0	<3.5 or >9.0
Salinity	0 to 30 cm <2	2 to 4	4 to 8	>8
(EC dS/m)	30 to 70 cm <3	3 to 5	5 to 8	>8
Sodicity (SAR)	<4	4 to 8	8 to 12	>12

TEXTURE and STRUCTURE

- Maintain or improve quality of the following categories:

Topsoil/Surface Soil	GOOD	FAIR	POOR
• Texture	FSL, VFSL, L, SiL, SL	CL, SCL, SiCL	S, LS, SiC, C, HC
• Soil Aggregate Size	<2 cm diameter	2 to 5 cm diameter	>5 to 10 cm diameter
• Soil Aggregate Structure	Granular or fine blocky	Powdery or medium blocky	Massive or large clods present
• Soil Aggregate Strength (Consistence)(m=moist; d=dry)	Friable	Loose, firm (m) or hard (d)	Very firm (m), or very hard to rigid (d)

Subsoil	GOOD	FAIR	POOR	VERY POOR
• Texture	FSL, VFSL, L, SiL, SL	CL, SCL, SiCL	S, LS, SiC, C, HC	
• Soil Aggregate Size	<2 cm diameter	2 to <10 cm diameter	10 to 30 cm diameter	>30 cm diameter
• Soil Aggregate Structure	Granular or fine blocky	Blocky	Large blocky	Massive or bedded
• Soil Aggregate Strength (Consistence)(m=moist; d=dry)	Friable	Slightly firm (m) or hard (d)	Very firm (m) or very hard (d)	Extremely hard or rigid (d)

2.3 VEGETATION

Quantitative assessment of Level I criteria may be required. Methods for the assessment will be provided by the Conservation and Reclamation Council.

APPENDIX 'D'

WELLSITE RECLAMATION CERTIFICATE APPLICATION

WELLSITE RECLAMATION CERTIFICATE APPLICATION

I. GENERAL INFORMATION

Applicant: ________________________

____

Address: ________________________

____

____

Contact Person: ________________________

Title: ________________________

Phone Number: ________________________

Address (if different from above): ____________

____

Landowner Name: ________________________

Address: ________________________

____

Phone Number: ________________________

Public Land ____ Private Land ____

Company File No.: ________________________

Disposition No.: ________________________

Well/Battery Name: ________________________

Well: __ Oil Wellsite __ Disposal Well

__ Gas Wellsite __ D&A Wellsite

__ Survey Only __ Prepared (Not Drilled)

Battery: __ Battery Site

Others: __ Campsite __ Borrow Site

__ Remote Sump __ Other (Describe) ________

Location: ________________________

Occupant Name: ________________________

Address: ________________________

____

Phone Number: ________________________

Provide 1 (one) copy of the current Certificate of Title (private land only) and 5 (five) copies of a survey plan, with the area to be certified outlined in yellow. The survey plan must cover one quarter-section. Details on the plan must be sufficient to show the relationship of the site to the immediately surrounding area, in particular with reference to the following: drainage locations and direction; slope direction; distance from waterbodies, streams, and sensitive areas; land use; bush; roads; trails; buildings; and fence lines.

II. SITE HISTORY (Attach information to this form)

1. Survey Date: ________________________
2. Construction Date: ________________________

   Ground Conditions: Wet Dry Frozen
3. Sump Backfill Date: ________________________

   Ground Conditions: Wet Dry Frozen

   Sump Location: __ On-Lease __ Remote

   Drilling mud (type, volume) ________________________

   Drilling waste disposal (location, method) ____________

   ____

   Attach any drilling waste disposal forms or plans supplied to the ERCB, Alberta Environmental Protection, or Alberta Agriculture, Food and Rural Development
4. Recontour Date: ________________________

   Ground Conditions: Wet Dry Frozen
5. Access Developed: __ Yes __ No; If yes,

   Low Profile __ High Profile __ Pit Run __ Crush __

   Access road to remain in place: __ Yes __ No
6. Seeding Date: ________________________

   Attach species mix list.
7. Spills: __ Yes __ No. If yes, explain and provide remedial action taken (supply all available information).
8. Herbicides/Sterilants: Provide details of chemicals used, dates, rates of applications, and mitigative measures.
9. Fertilizers: Identify types, rates, and date last used.
10. Soil Amendments: Identify types, amounts, rates, date(s) of application and method of incorporation.
11. Identify brush disposal method/location: ____________

    ____

    ____
12. Underground facilities removed (storage tanks, pipelines, etc.): __ Yes __ No. If no, explain.
13. Water supply well drilled on Lease Area: __ Yes __ No

    If yes, please supply the driller's name and address ____

    ____

    Water well to remain in place: __ Yes __ No
14. Well pad to remain in place: __ Yes __ No
15. Fences to remain in place: __ Yes __ No
16. Concrete, gravel or other debris buried on-site:

    __ Yes __ No. If yes, at what depth: ________ metres
17. Other improvements to remain in place (specify): ________________________
18. Releases for improvements to remain are attached: __ Yes
19. Improvements are in suitable condition: __ Yes __ No

III. SITE DATA Well/Battery Name: ____________________ Location: ______________________

Site data must be obtained for landscape, topsoil/surface soil, subsoil and vegetation components and compared to pre-disturbance (or representative adjacent) conditions. Site and pre-disturbance conditions should then be assessed by using the Level I criteria outlined in the Reclamation Criteria for Wellsites and Associated Facilities document.

Person who conducted the Level I assessment: __________________________ **Company:** ____________________

Topsoil/Surface Soil Depths (cm) - indicate and number sampling locations on the diagram

Control				Site			
____	____	____	____	____	____	____	____
____	____	____	____	____	____	____	____
____	____	____	____	____	____	____	____
____	____	____	____	____	____	____	____
____	____	____	____	____	____	____	____
____	____	____	____	____	____	____	____
____	____	____	____	____	____	____	____

FILL IN WHITE SPACES ONLY (NOTE: All the Meets Criteria boxes must be YES to obtain a certificate)

COMPONENT	CONTROL CONDITIONS	RECLAIMED CONDITIONS	MEETS CRITERIA?
1. LANDSCAPE			
Drainage	▨	▨	
Erosion	▨	▨	
Contour	▨	▨	
Stability	▨	▨	
Coarse Fragments	▨	▨	▨
Private Land	▨	▨	▨
% <10 cm			
% >10 cm			
Public Land - % (All Sizes)			
Debris	▨	▨	
2. TOPSOIL/SURFACE SOIL			
Topsoil Depth (cm)			
Topsoil Quality	▨	▨	
Surface Soil Depth (cm)			
Salinity	▨	▨	
Coarse Fragments	▨	▨	▨
Private Land	▨	▨	▨
% <10 cm			
% >10 cm			
Public Land - % (All Sizes)			
Compactness Rating			
3. SUBSOIL			
Salinity	▨	▨	
Coarse Fragments	▨	▨	▨
Private Land %			
Public Land %			
Compactness Rating			
4. VEGETATION			
Species Composition	▨	▨	
Vigour	▨	▨	
Height, Density	▨	▨	
Cover	▨	▨	
Rooting Restrictions	▨	▨	
Bare Areas	▨	▨	

IV. OTHER INFORMATION REQUIRED Well/Battery Name: ____________________ Location: ____________________

1. Private Land: Have you performed a final inspection in the presence of the landowner/occupant: __ Yes __ No

Public Land: Have you performed a final inspection in the presence of the occupant: __ Yes __ No

Date: ____________________

Landowner/Occupant Concerns: ____________________

____

2. For public land, have all lease conditions been met: __ Yes __ No. If no, state reason ____________________

3. Does a company representative wish to attend the reclamation inquiry: __ Yes __ No

Name: ____________________ Phone Number: ____________

V. DECLARATION

The Declaration must be signed by a representative of the licensed operator.

I, ____________________ of ____________________ certify that, to the best of my knowledge, all the above

(print name) (licensed operator)

information is accurate and that all other conditions described in the document Reclamation Criteria for Wellsites and Associated Facilities have been met, and that there are no soil chemical or physical conditions that resulted from

____________________'s use of this land that may adversely affect soil or vegetation or groundwater on or near the

(licensed operator)

site described above.

____________________ ____________________ ____________________

NAME (SIGNATURE) POSITION DATE

Return this application and a duplicate copy to:

Chairman, Conservation and Reclamation Council, Land Reclamation Division, Alberta Environmental Protection, 3rd Floor, 9820 - 106 Street, EDMONTON, Alberta T5K 2J6 for all private lands.

Deputy Chairman, Conservation and Reclamation Council, Land and Forest Services, 5th Floor, 9920 - 108 Street, EDMONTON, Alberta T5K 2M4 for all lands in the Green Area administered under the Public Lands Act.

Deputy Chairman, Conservation and Reclamation Council, Alberta Agriculture, Food and Rural Development, 2nd Floor, 7000 - 113 Street, EDMONTON, Alberta T6H 5T6 for all lands in the White Area administered under the Public Lands Act.

Well/Battery Name: ____________________ Location: ________________________

SITE SKETCH

CONSTRUCTION PHASE

Please indicate the following on the sketch:

Drainage	→ →	Wellhead	• wh	Berms	Berm	Cut/fill	
Spoil	sp	Spills	spill	Trenches	tr	Access	ac
Topsoil Pile	ts	Subsoil Pile	ss	Sump	sump	Flare Pit	fp

OPERATIONS PHASE

Please indicate the following on the sketch:

Wellhead	• wh
Topsoil Location	ts
Subsoil Location	ss
Teardrop	

APPENDIX 'E'

LIST OF WORKSHOP PARTICIPANTS

LIST OF WORKSHOP PARTICIPANTS

Name	Affiliation	Location
ANDERSON, Murray	Alberta Environmental Protection-LFS	Edmonton
BIEGEL, Jeff	Alberta Environmental Protection-Land Rec.	Grande Prairie
BILLINGS, Alvin	Rural Improvement Districts Association	High Prairie
BOSSENBERRY, Tim	Pedocan Land Evaluation Ltd.	Edmonton
BRADLEY, John	Alberta Environmental Protection-LFS	Grande Prairie
BROCKE, Larry	Alberta Environmental Protection-Land Rec.	Edmonton
BULMAN, Jerry	Parkvalley Consulting Ltd.	Calgary
BURKE, Jim	NOVA Corporation of Alberta	Calgary
BUXTON, Roger	Unifarm	Consort
CALDER, Lowell	Alberta Agriculture, Food and Rural Development	Lethbridge
CHANT, Richard*	Pembina Institute of Appropriate Development	Drayton Valley
CLOUTIER, Collette	Pan Canadian Petroleum Ltd.	Calgary
COLE, Barry	Alberta Agriculture, Food and Rural Development	Red Deer
DRUMMOND, Neil	Imperial Oil Ltd.	Redwater
FEDKENHEUER, Al	NOVA Corporation of Alberta	Calgary
FINLAYSON, Nancy	Land Resources Network Ltd.	Edmonton
FORKHEIM, Terry	Norcen Energy Resources Ltd.	Calgary
GERLING, Heather	Alberta Agriculture, Food and Rural Development	Edmonton
GERWING, Perry	Gulf Canada Resources Ltd.	Calgary
GRAHN, Dan	Alberta Agriculture, Food and Rural Development	Edmonton
GRANT, Tom	Alberta Environmental Protection-LFS	Edson
HARTLEY, Jeff	Alberta Agriculture, Food and Rural Development	Grande Prairie
HEEMERYCK, Ken	Pinnacle Resources	Calgary
HUBL, Kandy	Tarragon Oil and Gas Ltd.	Calgary
JACKSON, Don	Construction Consultant	Spruce Grove
JANZ, Arnold	Alberta Environmental Protection-Land Rec.	Edmonton
KNAPIK, Len	Pedocan Land Evaluation Ltd.	Edmonton
LESKIW, Leonard	Can-Ag Enterprises Ltd.	Edmonton
LLOYD, David	Alberta Environmental Protection-Land Rec.	Edmonton
LYSENG, Keith	Alberta Agriculture, Food and Rural Development	Edmonton
MAHNIC, Bob	Communiplan Inc.	Edmonton
MANDRUSIAK, Gary	Alberta Environmental Protection-LFS	Rocky Mtn. House
MARIO, Brian	B.J. Mario Enterprises Ltd.	Castor
MELNYK, Michael	Alberta Environmental Protection-Land Rec.	Calgary
MILLER, Les	Alberta Surface Rights Board	Edmonton
MOTT, Gary	G.C. Mott Associates	Calgary
NEAL, Vern	Alberta Environmental Protection-LFS	High Level
NICHOLS, Tony*	Alberta Surface Rights Federation	Castor
NORRIE, Don	Double "D" Drilling	Picture Butte
OSTERTAG, Rick	Alberta Environmental Protection-Land Rec.	Stony Plain

LIST OF WORKSHOP PARTICIPANTS (Concluded)

Name	Affiliation	Location
POWTER, Chris	Alberta Environmental Protection-Land Rec.	Edmonton
PROCTOR, Ian	Renaissance Energy Ltd.	Calgary
RIEP, Bruce	Murphy Oil Company Ltd.	Calgary
ROGERSON, Don	Interceptor Holdings	Grande Prairie
SCHOOLER, Don*	Special Areas Board	Hanna
SCOTT, Ian	Canadian Association of Petroleum Producers	Calgary
SKARSTOL, Stephen	Energy Resources Conservation Board	Calgary
SLAGHT, Daniel	Alberta Environmental Protection-AFS	Lac La Biche
SMITH, Jim	Mancroft Resource Consultants	Olds
SMITH, Rand	Alberta Energy	Edmonton
STANILAND, Rob	Talisman Energy	Calgary
STRETCH, Keith	Alberta Agriculture, Food and Rural Development	Rocky Mtn. House
TAKYI, Sam	Alberta Environmental Protection-LFS	Edmonton
TESTA, Gerard	KBL Land Use Consulting Ltd.	Calgary
THOMPSON, Don	Petro-Canada Resources	Calgary
VAN INGEN, Fred	Alberta Cattle Commission	Calgary
WALTON, Linda	Alberta Assoc. of Municipal Districts and Counties	Edmonton
WEBSTER, Gary	Canadian Association of Petroleum Producers	Calgary
WELESCHUK, Ivan	Energy Resources Conservation Board	Calgary
WELSH, Don	Alberta Environmental Protection-Land Rec.	Red Deer
WOODS, Ralph	Alberta Environmental Protection-LFS	Peace River
ZIMMERMAN, Peter	Amoco Canada Petroleum Company Ltd.	Calgary

** indicates registered for workshop but unable to attend*

APPENDIX 'F'

STATISTICAL SUMMARY OF 1993 INDUSTRY EXPERIENCE WITH WELLSITE RECLAMATION CRITERIA

The following are summaries of site assessment conducted as per the 1993 criteria requirement. As much detail as available is provided about the specific parameters failed, as well as a best-guess of which sites should probably have passed an are not worth further reclamation. Consultant understanding of the information requirements varied, and their greater or lesser familiarity with different aspects was reflected in the details they observed.

SUMMARY TABLE TOTALS (Dispute Information)

Black Soils; Primarily cultivated; Already rebuilt with borrowed topsoil. 40% of sites had no vegetation to judge.

Totals; and Dispute type (strictly judged by 1993 criteria)	% of total	#Sites (total)	Topsoil Depth (# fail)	Topsoil Quality Adm-Cmp-St-Agg-Tx	Subsoil Cmp-St-Sal	Vegetation "Perf" - BrSp	Landscape Slmp-Cntr-Er
Total Sites		51					
Total: Passes	2	1					
Total: Failures	98	50	42	27 - 5 - 12 - 7 -	5 - 5 -	3 - 3	1 - 6 -
Total: Failures Disputed	80	41		24 - 5 - 12 - 7 -	5 - 5 -	3 - 3	1 - 5 -
"no rework justifiable" (common sense)	39	20	20	18 - 3 - 3 - 5 -	5 - 3 -		- 3 -
"minor rework"; or benefits debatable	41	21	17	6 - 2 - 9 - 2 -	- 2 -	3 - 3	- 2 -
Total: Failures not disputed	18	9	5	3 - - -			1 -

Key:

Adm = Admixing
Cmp = Compaction
St = Stones
Agg = Aggregates

Tx = Texture
Sal = Salinity
"Perf" = Performance
BrSp = Bare Spots

Slmp = Slumping
Cntr = Contour
Er = Erosion

SUMMARY TABLE TOTALS (Dispute Information)

Brown through Black soils; mix of cultivated, bush and forage; unbiased representation.

Totals; and Dispute type (strictly judged by 1993 criteria)	% of total	#Sites (total)	Topsoil Depth (# fail)	Topsoil Quality Adm-Cmp-St-Agg-Tx	Subsoil Cmp-St-Sal	Vegetation "Perf" - BrSp	Landscape Slmp-Cntr-Er
Total Sites		12					
Total: Passes	0	(2 did pass) 0					
Total: Failures	100	12	7	7 - 1 - 2 - 5 - 1	2 - - 1	- 6	
Total: Failures Disputed	83	10	6	7 - 1 - 2 - 5 - 1	1 - - 1	- 5	
"no rework justifiable" (common sense)	33	4	3	5 - - 1 - 4 - 1	1 - - 1	- 3	
"minor rework"; or benefits debatable	50	6	3	2 - 1 - 1 - 1 -		- 2	
Total: Failures not disputed	17	2	1		1 -	- 1	

SUMMARY TABLE TOTALS (Dispute Information)

Dominantly Brown soils; mainly cultivated; unbiased sample. Summary based on review by consultant.

Totals; and Dispute type (strictly judged by 1993 criteria)	% of total	#Sites (total)	Topsoil Depth (# fail)	Topsoil Quality Adm-Cmp-St-Agg-Tx	Subsoil Cmp-St-Sal	Vegetation "Perf" - BrSp	Landscape Slmp-Cntr-
Total Sites		79					
Total: Passes	19	15					
Total: Failures	81	64					
Total: Failures Disputed	68	54	8+	28 - 7 - 5 -	39 -		
"no rework justifiable" (common sense)							
"minor rework"; or benefits debatable							
Total: Failures not disputed	13	10					

SUMMARY TABLE TOTALS (Dispute Information)

Black soils; primarily cultivated land; already reconstructed with topsoil borrow and decompaction. Summary based on review by consultant.

Totals; and Dispute type (strictly judged by 1993 criteria)	% of total	#Sites (total)	Topsoil Depth (# fail)	Topsoil Quality Adm-Cmp-St-Agg-Tx	Subsoil Cmp-St-Sal	Vegetation "Perf" - BrSp	Landscape Slmp-Cntr-
Total Sites		96					
Total: Passes	2	2					
Total: Failures	98	94					
Total: Failures Disputed	82	79	approx. 60	approx.20- - - -			
"no rework justifiable" (common sense)	78	75					
"minor rework"; or benefits debatable	4	4					
Total: Failures not disputed	16	15					

SUMMARY TABLE TOTALS (Dispute Information)

Green zone site visits; Bush/muskeg terrain; no soils assessment

Totals; and Dispute type (strictly judged by 1993 criteria)	% of total	#Sites (total)	Vegetation performance Cover - Bare Spots	Landscape (all padded to a degree) Slumped sumps -Contour-Erosion
Total Sites		14		
Total: Passes	21	3		
Total: Failures	79	11		
Total: Failures Disputed	57	8	- 2	8 - 2 -
"no rework justifiable" (common sense)	50	7	- 1	8 - 1 -
"minor rework"; or benefits debatable	7	1	- 1	8 - 1 -
Total: Failures not disputed	21	3	1 - 2	

APPENDIX 'G'

SAMPLE WELLSITE RECLAMATION CRITERIA COMMENT SHEETS

Wellsite Reclamation Criteria Comments	
Issue	Comment and Suggested Changes
Information Letter	
General comments	
Code of Practice	
General comments	
Criteria Package - General	
Contaminants not addressed in the criteria	
No sampling or analysis required	
Second inquiries receive lower priority	

Wellsite Reclamation Criteria Comments	
Time and cost to undertake the assessment	
Different criteria for private and public land	
Criteria Package - Level I	
Level I criteria vs. Level II criteria	
Landscape - general	
Landscape - Drainage	
Landscape - Erosion	

Wellsite Reclamation Criteria Comments	
Landscape - Contour	
Landscape - Stability	
Landscape - Coarse fragments	
Landscape - Debris	
Topsoil definition	
Surface soil definition	

Wellsite Reclamation Criteria Comments	
Topsoil/surface soil sampling scheme	
Access road sampling scheme	
Control site sampling scheme	
Topsoil/surface soil quantity - % average depth replacement - number of sites allowed to have less soil than average	

Wellsite Reclamation Criteria Comments	
Topsoil quality - measurement methods - % admixing - texture triangle - aggregate size - aggregate strength - layering	
Topsoil/surface soil - salinity	
Topsoil/surface soil - coarse fragments	
Topsoil/surface soil - compactness	
Subsoil sampling scheme	

Wellsite Reclamation Criteria Comments	
Subsoil - salinity	
Subsoil - coarse fragments	
Subsoil - compactness	
Vegetation must be present at assessment time	
Length of time vegetation must have been present at time of inquiry	
Vegetation - species composition	

Wellsite Reclamation Criteria Comments	
Vegetation - height and density	
Vegetation - cover	
Vegetation - rooting	
Vegetation - bare areas	
Criteria Package - Level II	
Landscape - slopes - erosion	
Soil - organic matter - chemistry	

Wellsite Reclamation Criteria Comments	
Vegetation	
Reclamation Certificate Application Form	
General comments	
Ease of use and format	
Survey plan	
General information section	
Site history section	
Site data section	

Wellsite Reclamation Criteria Comments	
Other information section	
Declaration section	
Site sketch - construction phase - operations phase	

PLEASE FEEL FREE TO ATTACH ADDITIONAL INFORMATION ON THE ABOVE QUESTIONS OR TO ADD ADDITIONAL GENERAL COMMENTS.

Name

Company/Organization

Please return comments to:
Chris Powter
Land Reclamation Division
Alberta Environmental Protection
3rd Floor, 9820 - 106 Street
EDMONTON T5K 2J6

APPENDIX 'H'

LIST OF GOVERNMENT, INDUSTRY, STAKEHOLDER AND CONSULTANT COMMENT SHEET AND LETTER/MEMO SUBMISSIONS

LIST OF GOVERNMENT, INDUSTRY, STAKEHOLDER AND CONSULTANT COMMENT SHEET AND LETTER/MEMO SUBMISSIONS

Code	Submitted By	Affiliation	Comment Sheet Submission Date	Letter/Memo Submission Date
GOV.01	Mandrusiak, Gary	AEP, Land and Forest Services	submitted/no date	not submitted
GOV.02	Gerling, Heather	AFRD, Public Land Management	submitted/no date	not submitted
GOV.03	Janz, Arnold	AEP, Land Reclamation	submitted/no date	not submitted
GOV.04	Black, Bill	AEP, Field Services	11/22/93	not submitted
GOV.05	North, Jim	AEP, Field Services	11/22/93	not submitted
GOV.06	Turner, C. and Jones, W.	AEP, Land Reclamation	12/06/93	not submitted
GOV.07	Ostertag, Rick	AEP, Field Services	11/22/93	not submitted
GOV.08	Patterson, Bruce	AEP, Field Services	11/22/93	not submitted
GOV.09	Welsh, Don	AEP, Field Services	11/22/93	not submitted
GOV.10	Demkiw, Steve	AEP, Field Services	11/22/93	not submitted
GOV.11	Malcolm, Al	AEP, Field Services	12/10/93	10/19/93
GOV.12	Harrison, Eugene	AEP, Field Services	11/22/93	not submitted
GOV.13	Melnyk, Michael	AEP, Field Services	12/13/93	12/13/93
GOV.14	McCabe, Don	AEP, Field Services	12/09/93	not submitted
GOV.15	Fisher, Bill	AEP, Field Services	11/22/93	not submitted
GOV.16	Smith, W.M.	AEP, Field Services	11/22/93	not submitted
GOV.17	Biegel, Jeff	AEP, Field Services	12/09/93	04/26/93 & 06/22/93
GOV.18	Carl, Wayne	AEP, Field Services	submitted/no date	not submitted
GOV.19	Johnson, Terry	AEP, Field Services	11/22/93	not submitted
GOV.20	Beddome, Doug	AEP, Land Reclamation	11/11/93	not submitted
GOV.21	Grahn, Dan	AFRD, Public Land Management	01/06/94	01/06/94
GOV.22	Tedder, Wayne	AFRD, Public Land Management	not submitted	06/28/93
GOV.23	Johnson, Richard	Alberta Environmental Centre	not submitted	02/09/93
GOV.24	Takyi, Sam	AEP, Land and Forest Services	submitted/no date	01/07/94
IND.01	Proctor, Ian	Renaissance Energy	11/16/93	11/16/93
IND.02	Johnson, Fred and Samis, N.	Fletcher Challenge Petroleum	11/09/93	11/09/93
IND.03	Mario, Brian	for Pan Canadian Petroleum	11/22/93	11/22/93
IND.04	Almond, Victor	Inverness Petroleum	12/01/93	not submitted
IND.05	Barker, Nelson	Unocal Canada	11/30/93	11/30/93
IND.06	Bolton, Alexander	Home Oil Company	11/17/93	not submitted
IND.07	Kear, Russ and Childs, Peter	Chevron Canada Resources	12/01/93	not submitted
IND.08	Heemeryck, Ken	for Pinnacle Resources	12/15/93	12/15/93
IND.09	Melnychyn, L.P.	Amerada Hess Canada	12/09/93	12/09/93
IND.10	Brewer, Ken	Norcen Energy Resources	submitted/no date	not submitted
IND.11	McRobbie, Neil	Atcor Resources	11/07/93	11/07/93
IND.12	Staniland, Rob	Talisman Energy	not submitted	submitted/no date
IND.13	Gayle, Jan	Shell Canada	not submitted	12/15/93
IND.14	Gayle, J. for Const. Super.	Construction Superintendents	11/16/93	11/16/93
IND.15	Thompson, Don	Petro-Canada Resources	submitted/no date	not submitted
IND.16	Fedkenheuer/Exner/Morck	Nova Corporation of Alberta	02/04/93	01/13/93
IND.17	Irwin, Tim	Mobilite	11/26/93	11/26/93
IND.18	Shand, John	Ranchmen's Resources	not submitted	11/16/93
IND.19	Lorenz, Garry	Husky Oil Operations	not submitted	11/14/93
IND.20	Webster, Gary	Cdn. Assn. Petroleum Producers	01/26/93	01/26/93 & 01/29/93
IND.21	Fry, Jim	Construction Supervisor	not submitted	12/20/93
IND.22	Oborne, Gordon	Construction Supervisor	not submitted	12/20/93
STA.01	Nichols, Tony	Alberta Surface Rights Fed'n	not submitted	07/06/93
STA.02	Van Ingen, Fred	Alberta Cattle Commission	not submitted	07/09/93
STA.03	Chant, Richard	Pembina Inst. for Approp. Devt.	01/31/94	08/13/93
STA.04	Ward, Norman	Western Stock Growers Assn.	01/18/94	01/18/94
CON.01	Fantin, Darren	Western Oilfield Environ. Serv.	submitted/no date	07/27/93
CON.02	Wolff, Bill	Bissett Resources Consultants	11/14/93	not submitted
CON.03	Twardy, A.	Pedocan Land Evaluation Serv.	not submitted	02/23/93
CON.04	Clark, Greg	TRS Abandonrite	not submitted	submitted/no date
CON.05	Ojamaa, Peter	Enviro-Field Services	01/12/94	not submitted
CON.06	Delorme/Schram/Sharkey/Smith	Mancroft Resource Consultants	not submitted	12/02/93 to 01/18/94

APPENDIX 'I'

WELLSITE RECLAMATION CRITERIA: COMMENT SHEET RESPONSES

WELLSITE RECLAMATION CRITERIA: COMMENT SHEET RESPONSES

Notes: 1. Respondents are not noted if *information was not provided* for a comment cell.
2. Respondents indicating only "good", "satisfactory", "acceptable" or "ok" are noted at the end of each section.

INFORMATION LETTER - GENERAL COMMENTS

Government Responses:

- Weak definition of "associated facilities". Does it include power lines, battery sites? Should be comprehensive list of what is and what is not included.

- Simplify - use plain language.

- Information letter should be designed to be attached to any documentation (license) sent to the landowner (operator) at the time of survey and site development so that they are aware of and can provide monitoring.

- Good. Very much needed. Should have more information letters.

- Information letter is straightforward and easy to understand.

- Two items: 1) clarify statement re: remote sumps, 2) introduce the notion that common sense will be applied – not the criteria hard and fast.

- Adequate at the time it first came out, i.e. early 1993, however, after revisions an update will be necessary.

- See memo (October 17, 1993) attached.

- The series of information letters has been in my estimation a very good idea. It gives industry additional information on matters pertaining to the criteria and I feel it helps answer a lot of questions.

- Yes very good. Will have to be amended to reflect usage, training, etc. Should reference expectations for crown and private lands, construction during wet, frozen or other adverse conditions. Could mention the native prairie issue.

- Use plain language.

Industry Responses:

- Pass/Fail criteria are not general enough for most older sites. An older site may fail, but no environmental impairment exists. More damage is done reworking that site (both environmentally and economically).

- Forestry and similar lands should have separate criteria. Criteria must be more user friendly. More input into land capabilities rather than justifications. System must be faster than currently. Winter construction must be taken into account. More R.O.'s need to clear out backlog, thus able to deal site specific to problems (maybe for summer months only). Yes/No not acceptable - possible explanations may be needed.

- Easy to understand.

- A glossary section needs to be added to the document to clarify terms and ensure consistency of understanding and use. For example, what is degraded soil, normal management or land capability equivalent? A training program will be necessary to successfully implement this document. Have there been considerations made for such a program?

- Good summary of problems and possible solutions.

Consultant Responses:

- Amend as you see fit. Try to redefine equivalent capability to make it more practical. Make or introduce concept to meet with officer on site to set out a reclamation plan for difficult sites, i.e. if you do something will it be accepted.

- The criteria do not reflect Alberta's climatic or geographic reality. They should be designed to work under frozen ground conditions and/or non-vegetated conditions, not the mid-July +24°C, crop growing assumptions now in place. Much too precise in its goals, there has to be license as to what (with available machines operating in winter especially) can be accomplished.

- Good/Satisfactory/Acceptable: Government (8 responses), Industry (3 responses), Consultants (1 response), Stakeholders (1 response).

CODE OF PRACTICE - GENERAL COMMENTS

Government Responses:

- Good - use plain language. Some ideas could be combined to shorten.

- Should include definitions of "conservation" as per Act, and "reclamation" as per attachment. Could be inserted in "specific factors" but should include somewhere to provide basic principles.

- More motherhood than minimum standards. However, the specific factors are good. Does not mention brush disposal.

- Straightforward and easy to understand.

- 1) Add communication to the first list and also indicate landowner approval of seed mix.
2) Under project planning add the initial point of site evaluation. Also introduce under "planning" proper equipment selection.

- Adequate - administrative correction -change Reclamation Officer to Inspector.

- Code is a very good idea, but find that individuals working in the industry have a lot of confusion as to what is a "requirement" of the actual criteria and what is recommended by the Code and is not necessarily a "requirement" (i.e., pre-site assessment confused as a requirement of the criteria when, in actuality, it is only a recommendation of the Code of Practice).

- Code standards good. Name "Code of Practice" not as effective as "Reclamation Requirements".

- Too vague.

- Very good. Change Reclamation Officer to Conservation & Reclamation Inspector.

- Good. Use plain language. Some ideas could be combined to shorten. AFRD needs to be mentioned under Site Preparation and Operation.

- We generally agree with the Code of Practice. We wish to make no suggestions for changes.

Industry Responses:

- Capability should be a major parameter as we have had an impact that must be weighed against the benefit. This is a reclamation not a restoration.

- If mainstream leases sent through system, less back up on failed leases. Quality and quantity parameters of criteria are confusing. More input into loss of production rather than total rental. Officers should be more available during reclamation. Intent to meet criteria is essential.

- Most items appear reasonable. Only exception is "on-site supervision of development and reclamation activities by personnel responsible for environmental quality control". This is currently handled by Home's construction foreman. Environment supervision of all projects not practical or possible.

- Practical and easy to follow.

- Statements 1, 2 and 10 all refer to pre-disturbance land capability or pre-development conditions. These terms contradict those found on page 1, paragraph 1 of the Reclamation Criteria. The Reclamation Criteria implies the site will be measured against a representative site condition, a location adjacent to or a short distance from the development. The lack of consistency in approach will cause confusion. In reference to Statement 2, acceptance of pre-development conditions as the standard implies restoration, not reclamation, limiting potential for improvement. For example, solonetzic soils. Statements 7-10 do not belong in the Code of Practice. They are quantitative actions which support the Code of Practice, rather than statements of philosophy.

- Assumes that environmental concerns today are the same as 40 years ago, and that today's practices were carried out 40 years ago. Several statements not in touch with reality. Disturbed sites can only be reclaimed so far artificially - then left for "time" to complete.

Consultant Responses:

- Goods statements regarding objectives in particular: 1) preassessment of site conditions prior to development, and 2) objectives of reclamation and conservation.

- Land capability to equivalent capability too demanding. Equivalent capability should not mean the same as before. Sustainable under normal management is good definition.

- Requires an attached definition description, i.e. what is normal management? Does pre-construction site assessment include photography? If not, why not? Timing concerns . . . is there a final reclamation timeline so that it doesn't end up being an ongoing reclamation project.

- Good/Satisfactory/Acceptable: Government (7 responses), Industry (4 responses).

CRITERIA PACKAGE - GENERAL
CONTAMINANTS NOT ADDRESSED IN THE CRITERIA

Government Responses:

- Some concern expressed initially. It would be helpful to have a flowchart outlining different processes and agencies involved.

- At some point we will need to clarify the protocol for management of chemicals.

- This is a very common point that industry asks all the time. Could give more direction on the procedures for handling.

- Site contamination should be a part of the package. Tier I requirements should be introduced. It may be necessary to include pipelines specifically.

- I believe the general comments to criteria, i.e. "all contamination must be treated prior to certification" combined with the declaration on the application should suffice.

- They are: first page "All contamination must be treated prior to certification".

- Statement that contaminants are to be treated in situ; no contaminants will be accepted as part of the reclaimed area. Fix the issue prior to application, eventual certification.

- Full reporting and disclosure should be supplied on all contaminants and should include sampling methodology (location, depth, etc.), analysis, remediation.

- Sites should be audited for subsurface contamination. High risk sites, batteries, compressor stations, herbicide/spill history should provide inspector on site assessment and results, and treatment/disposal method of contaminated soils.

- What is meant by this question? Are you referring to specific types or forms of contaminants or just contaminants in general? This could also mean who will determine how contaminants are to be handled. Needs further clarification.

- It is a good idea that contaminants are not addressed in the criteria because it would make the document far too lengthy and very complicated. It was my understanding that the initial objective of the criteria was simplicity "keep it simple".

- Addressed in Level II.

- Level II.

- It should be clearly stated in the introduction that contaminants are not addressed by these criteria. A flowchart that outlines the involvement of different agencies during the reclamation process would be useful.

Industry Responses:

- They are adequately addressed elsewhere.

- Should only apply to site specific cases.

- Vegetation - Noxious weeds?

- Contaminants would be addressed if the site requires testing under the Decommissioning & Reclamation Guidelines for small oil and gas facilities in Western Canada.

- Not required if other criteria are met.

- It is my understanding that no contaminants are acceptable (if encountered, a Level II assessment is required to determine type and amount).

- Information is available from Department of Environment (theoretically). Some large grey areas as to which Department is responsible for what (ERCB/AEP/AFS/Water Resources).

- Drilling mud is a soil contaminant which cannot be properly mixed or buried on the site. Long term results on native vegetation indicate a very much reduced plant growth and vigor on wellsites that have used open mud pits. Recommendation: No mud pits in areas of native vegetation.

Stakeholder Responses:

- It is the responsibility of each operator to honestly report results of any soil conditions which required treatment.

Consultant Responses:

- Make criteria as practical as possible. CAPP should work with some of its members to set up a few more forms/data sheets to follow and document information so that construction supervisors and regular dirt contractors can learn to do this for us and avoid sending out specialists to do this, separate from the work our construction people do.

- Good/Satisfactory/Acceptable: Government (1 response), Industry (3 responses).

CRITERIA PACKAGE - GENERAL
NO SAMPLING OR ANALYSIS REQUIRED

Government Responses:

■ Sampling/analysis should be standard on sites where drilling wastes land farmed (or land spread off site), or where other contaminants known (sterilants, pesticides).

■ Generally support no detailed sampling in Level I and use of analysis for Level II if a problem is suspected.

■ A statement to include "Representative areas in the four quadrants, at well center and wellsite entrance should be sampled and analyzed for OM, texture, salinity package wherever uncertainty exists as to the degree of degradation in those components".

■ A proper assessment with good vegetation results will maintain the existing status quo re. certification. Sampling would be an extra cost that has not been demonstrated to be necessary.

■ Normally most D & A sites do not present contamination problems but numerous old production sites do at wellheads, flarepits, sumps, tanks, etc. Sampling should be necessary on these at these specific facilities. Therefore need some Level II assessment on old production sites.

■ Laboratory analyses are requested when problems are apparent.

■ Sampling should be available as option for Reclamation Inspector and Company.

■ Should be required if Level I criteria has been exceeded and company wants to justify the application and argue that further remedial measures are not required or will not benefit.

■ OK for low risk sites. My experience tells me that old compressor stations will likely have subsurface contamination.

■ Of what?

■ In my opinion, no sampling gives industry a break. Slight to intermediate damage on locations is not always visible to the naked eye but under the magnifying glass (soil analysis) becomes very obvious. Allowing sites to be certified based on a visual assessment allows a location to pass that would likely not pass under lab analysis.

■ Staff support the current Level I (no detailed sampling) and Level II (use of analysis) when a problem is suspected.

Industry Responses:

■ Laboratory analysis should not be required as this would add a significant cost and effort for information of doubtful usefulness.

■ Yes, if this would help us get certifications on cultivation.

■ This should apply only to site specific cases.

■ As an industry, sampling and analysis is the only tool we have to prove now or in the future what we have or have not done to the land. A good paper trail stands up well in disputes.

■ Not necessary for Level 1. Sampling and analysis would be at the discretion of the operator.

■ Wellsites and/or access roads in remote muskeg type locations should be allowed a measure of discretion as to sampling requirements.

■ This should remain at the discretion of the reclaiming company.

■ Although none are required, it would be advantageous for industry to be able to provide the chemical information in special cases and have it accepted along with the physical soil properties which are reviewed during the site inquiry.

■ Analysis may be required if there is knowledge or evidence of contamination on-site or adjacent to the location.

Stakeholder Responses:

- If only field assessments are required then a more detailed approach will be needed to identify "problem areas" beforehand. This leaves too much open to the opinion of the company using the site. Define what problem areas are or make everyone do a soil assessment.

Consultant Responses:

- Soil sampling and analysis should be kept to a minimum. To be done to investigate a problem (e.g. bare patches, lack of overall growth, etc.).

- Good/Satisfactory/Acceptable: Government (3 responses), Industry (2 responses), Consultants (1 response)

CRITERIA PACKAGE - GENERAL
SECOND INQUIRIES RECEIVE LOWER PRIORITY

Government Responses:

- Staff do spend a considerable amount of time doing repeat inspections to see if sites are ready for certification. Staff generally support a system that encourages doing a good job the first time. Some would prefer a more positive approach.

- The idea is fine, however, when you plan your day you may look at all one company or you may travel to one geographic area and look at wells in that area. Again, I agree with second inquiries receiving a lower priority.

- A good standard because of the volume we deal with. Minor deficiencies like rocks, fences, etc. are not withheld as strenuously.

- For situations of site failure on a number of points, the concept is good. Where the inspection showed marginal concerns (i.e. admixing or density of vegetation), we may wait and reschedule for later that year or the next year. The "Want More Time" sites would not be dropped in priority.

- This is necessary. It promotes good and correct reclamation.

- This policy does not allow for follow-up inspections to ensure the work is done nor does it assist the landowner in getting the problem fixed and the site returned to its equivalent capability.

- Agree. But can usually squeeze in sites where deficiencies are promptly corrected by company.

- Good idea. LCRC's present and future workload requires we priorize inspections, putting the onus back on industry, will hopefully assure that they will do their best job the first time. Also assures less return trips back to locations by LCRC. Will also likely reduce the "free consulting" LCRC provides on marginally acceptable or unacceptable locations.

- Standard practice.

- Update to show return of applications until company has submitted written confirmation of which deficiencies were corrected.

- Staff support a system that encourages doing a good job the first time. Application fee for second and subsequent inquiries has been suggested.

Industry Responses:

- Subject to criteria revision, this principal is acceptable. Operator's "track record" should be considered. Inspectors need to be more available during reclamation operations for guidance and consultation.

- With the uncertainty regarding what will and will not fail, a failure should not penalize the operator in terms of additional years of rentals.

- No. If failure was marginal or of a small parameter, the inspection should be judged on common sense and company past performance.

- Should not be common to all cases. Farming practices and nature dictate abnormal years and must be accounted for.

- Although this is intended to increase success rate for first time inspections, it may not be fair in all cases - should be dependent upon reason for failure, i.e. obvious poor reclamation job or reclamation not complete versus minor shortcoming which may not be immediately obvious or subject to interpretation.

- Use outside agencies to accelerate the process, putting cost and responsibility back to the operator, not government. Priority is to get the work done right the first time, however a failure should not automatically put the operator in the penalty box. The Reclamation Inspector should be available during the reclamation operations on exceptionally difficult locations and at the start of major projects for guidance and consultation.

- Agreed, as reclamation should be properly conducted prior to application. However, it should be based on the past performance of the operator, not on the failed site only.

- Lower priority on second inquiries should be relaxed until industry have people trained in new requirements and are aware of AEP expectations.

- Is fair in most cases but the time of inquiry should be indicated.

- Second inquiries should be very minimal - recommend new criteria used if second inquiry necessary. Second inquiries that are the result of a minor problem (i.e. small patch of ground with less grass catch) should not be penalized with a lower priority. We have leases that applications for certificates were submitted 2 years ago that have not been acted on. If a lease is destined to receive a lower priority, are we looking at 5-10 years?

- Subject to criteria revisions, this principal is acceptable. An operators total record should be considered, and a small number of failures should not be cause to penalize. The Reclamation Inspector should be available during the reclamation operations on exceptionally difficult locations and at the start of major projects for guidance and consultation.

- Ensures that remedial reclamation is completed properly the first time. Does not take into consideration difference of opinion between company & Reclamation Inspectors or unattainable objectives of Inspector in reclaiming 40 year old site where there was zero (0) topsoil conservation during construction phase, and approved operating practice of 40 years ago was different than today.

Stakeholder Responses:

- Disagree. Second inquiries should receive a higher priority otherwise problems may continue to the detriment of the environment.

Consultant Responses:

- This should be waived if the company provides documentation that the conditions responsible for rejection have been rectified.

- Fair but there should be an avoidance of undue delays for second inspection. Mention should be made for unusual or difficult sites that industry can ask for pre-reclamation site meetings and that LCRC will come, listen and perhaps agree to a reclamation plan upfront. Then industry has to do the job correctly and within normal standards.

- Fine - too bad there wasn't more "teeth" up front.

- Good/Satisfactory/Acceptable: Government (8 responses), Stakeholders (1 response)

CRITERIA PACKAGE - GENERAL
TIME AND COST TO UNDERTAKE ASSESSMENT

Government Responses:

- Should not be an issue.

- Staff have indicated that the level of assessment is onerous for both industry and reclamation officers. The length of time required to conduct an inquiry will double or triple. This will create severe time pressures in active parts of province.

- Not our problem. This intensity ensures companies do their work.

- The initial time and cost exceeds additional lease payments and remedial work which industry gets if an unsatisfactory site is submitted. The cost of time and money should not be an issue. The only loss is our withdrawal of free consulting services.

- Proper pre- and post assessments are necessary and this is a cost of doing business. People naturally reject change but the change in procedures is very necessary.

- My experience indicates it will take 2.5 to 3 hours per wellsite under good soil conditions, assuming it passes under Level I.

- Sounds like $400 to $600.

- Industry should have been undertaking their own assessments instead of the reclamation officer. This should not be an issue. It is merely a transfer of responsibility back to the industry. User pay.

- Time and cost on the company assessment should save time and cost by the Council, hopefully, enabling us to meet 60 day turnaround.

- As industry becomes used to working with the criteria, time and costs will decrease.

- In the total picture, cost of assessment is minuscule "diminimus" especially when you consider that the intent of the assessment is to eventually result in abandonment cost savings. The following formula proves this point. Known: average cost of assessment, lease construction and abandonment (reference: Information Letter LCRC/IL/93-1) = tens of thousands \$ (1×10^4) dollars. Known: average total cost of drilling (1×10^5 to 1×10^6) dollars (includes construction and abandonment + possible revenues from production (1×10^6 to 1×10^7) dollars = tens of millions of \$ (1×10^7). The cost of assessment, lease construction and abandonment is small in comparison to total cost of drilling and even smaller if revenues from production are added.

- Not a factor

- Not a concern. Average consultant can do.

- Whose cost? Could further expand upon to indicate benefits to industry of proper supervision throughout project and cost savings when certified at first inquiry (equipment moved, rentals, redoing work and effects upon materials, etc.).

- It is estimated that the time taken to conduct an inquiry will triple. This is expected to decrease as the companies provide more complete information. There will be severe time pressures in active parts of the province.

Industry Responses:

- OK subject to a revision in Criteria. Acceptable if it speeds up the process.

- Use a graduated scale according to well site age to justify costs for older abandoned and suspended well sites. Cost/benefit must be reasonable.

- Worth the effort if the success rate goes up. We need a very quick turnaround on sites that are ready for inspection. We cannot afford to re-assess the old sites that were before the new criteria and need those inspections as well.

- Very expensive and time consuming. If it still needs inspection, it becomes a total waste of time and money.

- Time and cost for assessments will be prohibitive. Assessment cannot be performed by construction foreman as was previously done. Will need to retain qualified environmental consultant or use in-house environment staff to complete assessments.

- Subject to a two-tier revision to the criteria, costs of the assessment are not a major issue. Costs acceptable if it speeds up process and no duplication of assessment work is required.

- Sampling points should be reduced. It now takes anywhere from 5 hours or more to do the minimum required assessment (two technicians).

- The completion of assessments necessitates greater expertise (than previously required) in soil sampling and characterization. Greater costs will be incurred by industry for use of soil consultants to ensure procedures are being completed properly.

- Final assessments are costing $500-$600. Prework assessments range from $300-$400.

- Approximately one half day per site = $500 maximum on site (does not include travel to and from).

- Subject to a two tier revision to the criteria, costs of the assessment are not a major issue. Costs are acceptable if it speeds up the process and no duplication of assessment work is required.

- Consideration of extra cost versus land capability does not seem to be addressed in the "Reclamation Criteria". Some site restorations of old locations may cost in excess of $50M to restore to required criteria, and will not produce $50M in 200 years. By that time natural restoration will have long been established.

Stakeholder Responses:

- Cost needs to be borne by industry.

Consultant Responses:

- The time we have noted is as follows: 4 hours for 1 person, 2 hours for 2 persons including travel, mileage and other disbursements, the cost usually averages approx. $500 per site. If a report to the client is required, approximately $600 per site not including laboratory analytical work.

- Needs to be redone. Expect 1 field day and 1 or more office days to do report writeup and application letters, etc. Try to make assessment more doable by the men and women who do field construction work.

- The topsoil checks at 25 per lease are too many. Do a statistical check - how many checks would be needed to reach the 99% confidence interval? My guess is much less than 25.

- Good/Satisfactory/Acceptable: Government (2 responses).

CRITERIA PACKAGE - GENERAL
DIFFERENT CRITERIA FOR PRIVATE AND PUBLIC LAND

Government Responses:

- Criteria for private land and cultivated public land should also be applied to public lands with improved grazing. Coarse fragments should be same for private, cultivated public or public improved grazing lands.

- Staff agree that lands that have no potential for annual cultivation should be treated differently from lands that are presently cropped annually or have the potential for that use. The criteria should clearly outline the differences. The rationale for this separation are the limitations posed by thin soil horizons, rough topography and variability of soil types both on and offsite (controls).

- I agree with this point. It's like comparing apples and oranges when you look at farm land compared to forested land which will never be put into crop. There should be two sets of criteria, one for permanent forested land and agricultural lands.

- A different land use will dictate a different degree of intensity.

- Some public land is in an area where possible sale is an option or it may be located within the developed areas. The separation should be for agricultural potential land and non-arable lands.

- Forest land use objectives are very different to private and potentially productive lands therefore differing criteria can apply.

- Criteria should be the same for different (1-5) classes of land, lower standards must be used on Class 7 lands. Impossible to develop and reclaim sites to the specification used in the criteria package using private land criteria. Public land criteria should be used on Class 6-7 lands.

- There should be no difference between private and public lands. The difference should be based on previous and present land uses, i.e. a busy (treed) location converted to pasture, concessions should be made for undeveloped lands being converted to developed, as with land clearing your soils change (Ae to Ap).

- May make things difficult.

- Reclamation criteria should be based on soils and land use issues present and future and not on ownership. There should be only one set of criteria for a specific soil unit.

- Differences justified by land uses.

- Only where the land capability is different should the criteria differ.

- We shouldn't have a double standard. Reclamation should be the same no matter which side the fence you are on.

- Has to be standardized on all lands (i.e. based on land use rather than ownership and whether it is cultivated or not. Present and future land use should determine which lands will be abandoned). Criteria is not clear for wellsites on crown land that go to title between construction and abandonment. To what standard should the site be abandoned?

- No, must have one standard.

- Should have same criteria. Use same standard as Public Lands for Class 6-7.

- The importance of proper conservation and reclamation must be stressed. The soil and the land use are different from agricultural lands and could reflect this difference in the explanation. It must be stressed that these parameters will be met on all levels. May have to take into account distances of travel to sites and may be limited due to location. The criteria should remain close between private and public.

- Staff support criteria that recognize differences in land use and management objectives. The controls at each site should determine the expectations for reclamation.

Industry Responses:

- Differentiate by "cultivated" vs "non-cultivated" 2 tiers and not by private vs public. Criteria for each tier needs input from operational persons enforcing the Act.

- This is needed as I believe we are trying to group too many different land uses into two groups.

- This is ridiculous. The location should be compared to original entrance as well as to the adjacent land for final approval.

- Should reflect actual/potential land use.

- AFS needs a set of guidelines that is fair and equitable from district to district even from area to area within a district. Differentiate by "cultivated" vs "non-cultivated" instead of private vs public (two tier system). Criteria for each tier needs input from the operational personnel enforcing the Act, i.e. forestry officers for the "non-cultivated" tier.

- Criteria should be different for private land, cultivated public land and non-cultivated public land (land on which there has never been a hay or cereal crop). Perhaps criteria should be based on land use, rather than ownership.

- One standard should be set to make criteria less confusing otherwise the criteria should be tied to arable vs non-arable rather than private/public.

- Would be less confusing and fairer if they were the same.

- This document is workable. However, it does pose a question - land is land, why the different criteria?

- Differentiate by "cultivated" vs "non-cultivated" instead of private vs public (two tier system). Criteria for each tier needs input from the operational personnel enforcing the Act, i.e. Forestry Officers for the "non- cultivated" tier.

- In reality there is different criteria for each Reclamation Inspector. Criteria for Green Areas is not consistent with what AFS are asking for. Some White Area public land inspectors are requiring that criteria be equivalent to private lands. Problems arise when land is reclassified from public to private land during the life of the disposition. Zero consideration given that the landowner has been fairly compensated for site disturbance, inconvenience and loss of use. Some Green Areas require abandoned locations to be table-top flat with nil woody debris and 100% vegetation cover regardless of soil conditions (i.e. grass on a gravel pit). Assumes that there will be negotiation between company representative and Reclamation Inspector in all cases.

Stakeholder Responses:

- Disagree. Soil is soil, therefore the criteria need to be the same for private and public land.

- In regard to coarse fragments allowed, the criteria should be the same for private and public land, especially if one is to define public lease land under private disposition as public land.

Consultant Responses:

- Differentiation should be defined. Public land - sustainable vegetation cover as an objective. Private land - acceptable as defined. Forested lands - end land use - timber production, aesthetics, compatible vegetation, fire hazard. Grassland - sustainable vegetation cover able to withstand grazing pressure and climatic conditions.

- It appears to be set out OK. Forestry and Public Lands appear to be more reasonable with administration policies. LCRC reps are too impractical re: private land.

- You have to address this internally. At this point we do not operate differently. Private vs public. Our recommendations are the same out of principle.

- Good/Satisfactory/Acceptable: Government (1 responses).

CRITERIA PACKAGE - LEVEL I
LEVEL I VS. LEVEL II

Government Responses:

- Staff support this split.

- Establish list of high risk sites: batteries, compressor stations, herbicide/spill history. Level II should be required for high risk sites.

- First paragraph - "you should undertake sampling and lab analyses when problems are apparent and the assessor is uncertain (undecided) about the degree of degradation of physical, chemical or biological components".

- The dual level system is required to ensure: 1) problem sites are evaluated by a competent person, and 2) have the company undertake a proper remedial (not cosmetic) program. Serves as additional push to do things right the first time.

- Again, most D & A sites need only Level I criteria assessment but older production sites should go to Level II because of the common occurrences of hydrocarbon contamination that can be masked easily.

- Difficult to determine class of land you're assessing (is it Class 5 or 6?).

- Logical progression.

- Several Level I criteria have not been addressed in the Level II criteria. Textural classes are not similar. No measurement for compactness (i.e. bulk density, infiltration, penetration resistance, vegetation, admixing).

- This is satisfactory so as to allow those sites which are standard with no problems to be assessed easier.

- Again standards vary - why?

- Has to be designed so that parameters under Level I properly mesh, in logical fashion, with Level II parameters (i.e. textural triangles should same for both levels, compaction added to Level II, soil strength added to Level I).

- Good explanation. There is no reference to acceptable depths for burial. This is probably good, however, it should be stressed that removal from site and disposal in approved landfill site is preferred option. Is 1.2m of cover satisfactory?

- Staff support this split but believe need for more links in the document between soils and vegetation criteria.

Industry Responses:

- Level I criteria in conjunction with other regulatory guidelines should allow an operator to meet objectives.

- In Level II the organic matter should be changed from 80% to 70%.

- Level II should in some cases be addressed prior to Level I. Is Level II really applicable?

- Level I plus other guidelines may meet objective. Level II not required.

- Standards between Level I and Level II criteria should be consistent. If the operator uses Level II criteria then the regulator should be bound by results.

- Level II criteria are not needed as it complicates and confuses most people as well as involves more time and manpower. No application need be made until Level I criteria are met.

- Level I criteria plus other guidelines, i.e. ERCB Pits & Ponds IL, MUST guidelines, etc. may meet objective, therefore purpose of Level II is unclear. Level II conflicts with other guidelines.

- The document notes that in Level I, field assessments are used rather than laboratory data, however, you should undertake sampling and analysis when problems are apparent, spills have occurred or sterilants have been used. This statement confuses idea of having two levels. If problems are apparent you must sample at Level II and remediate if necessary. It is suggested that the operator has the option of supporting his claim of reclamation success with laboratory data whether or not a problem has been identified. No discussion of how many increments need to be assessed in the subsoil region. Will the subsoil be assessed as a single unit to depth or divided into upper and lower subsoil?

- Why two levels when all assessments must meet Level I evaluations?

- Clarification of Level I - always perform a Level I. At what point is a Level II generated? Some problems may be solved without the need to sample. Need a formal definition of Level II. What would initiate Level II?

Stakeholder Responses:

- In Level I, who determines when problems are apparent? If left up to the proponent, problems may never become apparent!

Consultant Responses:

- OK. Too many soil samples per site and too restrictive on variance of topsoil replacement.

- I like the Level II criteria because it allows for certification outside the "active" growing season, i.e. without vegetation. This is a minor expense considering what has been spent so far.

- Good/Satisfactory/Acceptable: Government (5 responses), Industry (2 responses), Consultants (1 response)

CRITERIA PACKAGE - LEVEL I
LANDSCAPE - GENERAL

Government Responses:

- No concern. Define "normal land use".

- Change to "differences between site and the adjacent land must not be so great that they interfere with normal land use and potential biodiversity of the area".

- "Recontour the site to original grade and drainage". In some cases this is not acceptable, in particular if it was a hill that a farmer had trouble farming over. This could be changed to have exceptions where it improves the land.

- May want to emphasize land use changes.

- Satisfactory except for variance in coarse fragments on public land.

- Define the term "normal land use". Add a new category - surface water that discusses sedimentation concerns.

Industry Responses:

- Allowance should be made for alterations to the landscape requested by the landowner if this has no significant environmental impact.

- Restructuring of land use must be accounted for. There should be no difference in private and public land that is used for the same purpose, e.g. forestry would be different than cultivated.

- No problem understanding - check topography and surrounding area.

- May not be practical to recontour a lease that is 100% vegetated with adequate erosion controls in place as reclamation is backed up to 0 and may take 3 to 5 years to re-establish (Green or White areas).

Stakeholder Responses:

- Need definition of "normal" land use.

Consultant Responses:

- Good, but allow for agreement with landowner to vary from original landscape.

Good/Satisfactory/Acceptable: Government (12 responses), Industry (6 responses), Stakeholders (1 response), Consultants (3 responses).

CRITERIA PACKAGE - LEVEL I
LANDSCAPE - DRAINAGE

Government Responses:

- How do we treat pads in muskegs?

- The use of "or" between direction and capacity "or" compatible with the surrounding landscape - should be changed to "and" or "and/or". Phrase "compatible with the surrounding landscape" is too open ended and may allow a company to justify a change in direction or capacity of a drainage pattern which contravenes the Water Resources Act.

- Concerns about allowing clay pads to remain in place on low areas, when there may be potential for land to be developed for agricultural use.

Industry Responses:

- Site specific application.

- Definition of expectations not clear. Add "compatible with the landscape".

- Good/Satisfactory/Acceptable: Government (15 responses), Industry (7 responses), Stakeholders (2 responses), Consultants (3 responses)

CRITERIA PACKAGE - LEVEL I
LANDSCAPE - EROSION

Government Responses:

- Can fabric cloth be left in place? A reasonable effort should be made to leave no erosion onsite, regardless of adjacent conditions. Rare exceptions should be allowable.

- Since the site will be nearly or recently reclaimed, there should not be any erosion evident on site. Management control of erosion should be a priority on these sites since erosion beginning on site can trigger erosion off-site.

- May want to add a further statement regarding future potential to increase.

- A very poor statement. By allowing erosion similar to adjacent lands, we are not promoting protection of our environment especially if the adjacent lands are being managed in such a way as to enhance erosion (i.e. farmer using farming techniques that are enhancing erosion adjacent to wellsite - also contravenes Soil Conservation Act).

- Reasonable effort should be made to leave no erosion onsite, regardless of adjacent conditions. Rare exceptions should be allowable.

Industry Responses:

- Site specific.

- No gullies or blowouts allowed in the reclaimed landscape. Difficult if not impossible to achieve, particularly if present within the original landscape.

Stakeholder Responses:

- What if adjacent land has gullies or blowouts due to poor practices? Need better yardstick to measure this by.

Consultant Responses:

- Erosion protection required.

Good/Satisfactory/Acceptable: Government (13 responses), Industry (7 responses), Stakeholders (1 response), Consultants (2 responses).

CRITERIA PACKAGE - LEVEL I
LANDSCAPE - CONTOUR

Government Responses:

- "Older, well vegetated and stabilized areas . . . " not well defined as being pre-1993.

- Scoop outs for borrow material made in 1950's and 1960's. Some were left open and some had the brush pushed into them and capped with clay. Are these considered associated facilities and to what standard should they be reclaimed? Staff agree with statement in criteria. Exemption of older sites if sensitive areas should not be redisturbed.

- There is no mention of "releases" to leave the contour as is.

- Good comment especially older sites.

- Landowner approval required for changes.

- Agree with statement in criteria. Exemption of older sites is okay. Sensitive areas not to be redisturbed.

Industry Responses:

- Grant an exemption if there is to be a significant change to the land use.

- Original contour should be exempt if land use is to change.

- Allow for exemption if there is to be a significant change to the land use.

- Requires a method of measurement for those sites where common agreement cannot be reached. Recontouring is not required if there is no negative impact on the site and will not interfere with normal land use. Should be exempt if the land use is going to change, i.e. cattle feeding area, corrals, gravel pit, etc.

- Final contour should have the flexibility to be altered to meet the landowners future land use. In hilly or rolling terrain, the lease may be left in a condition where it can be farmed, however, the contours may not meet the guidelines.

- Requires a method of measurement for those sites where common agreement cannot be reached. Recontouring is not required if there is no negative impact to the site and it will not interfere with normal land use. Should be exempt if the use of the land is going to change (i.e. the lease is becoming part of a gravel pit).

- New contour may be more useful for landowner

- Site specific.

Consultant Responses:

- Allow for agreement with landowner to vary from original landscape as long as drainage, erosion, etc. are proper. Emphasize contour of subsoil before topsoil replacement.

Good/Satisfactory/Acceptable: Government (13 responses), Industry (3 responses), Stakeholders (1 response), Consultants (2 responses).

CRITERIA PACKAGE - LEVEL I
LANDSCAPE - STABILITY

Government Responses:

- Seepages should be included and addressed in submissions.

- Problems are not always evident at inquiry.

- Add to current statement - no practice should be used that could lead to future subsidence on site, e.g. burial of brush.

Industry Responses:

- Site specific.

- Unless this problem is prevalent in adjacent off-lease areas.

- Perhaps reasonable time should be allowed to stabilize landscape, however, this waiting period may already be covered under the 5 year liability on certification.

- In remote areas if slight settling of sump areas etc. is not causing a problem there should be consideration - costs vs results of leaving as is (not consistent from area to area).

Stakeholder Responses:

- Timeline on this criteria?

Consultant Responses:

- Required to meet that in nature.

- Good/Satisfactory/Acceptable: Government (14 responses), Industry (5 responses), Stakeholders (1 response), Consultants (2 responses).

CRITERIA PACKAGE - LEVEL I
LANDSCAPE - COARSE FRAGMENTS

- Private land criteria should apply to cultivated public land and public land with improved grazing.

- May be hard to assess with vegetative cover in place. Difficult to judge 10%, 20% more realistic.

- We should formulate a graph for this one. Public lands should be treated as private land on White Zone fringe.

- The wording should be changed to "rocks". Plain language please.

- Good, key is common sense and comparability.

- The public land figure must be changed to have a rider "nothing exceeding a set size" up to 25cm?

- Mixed feelings. A 5-10% increase in 10cm may be more acceptable - it depends on soil type and site position (hill top versus flat land). Sometimes parent material and subsurface are laced with rock.

- Does not specify the area over which coarse fragments are assessed. No distribution standard - this is required to avoid any anomalies.

- Eliminate variance with public land.

- Spreading of gravel on private lands to fall within the allowable 10% should not be acceptable, i.e. well turn-around, access road. Some do this while others are screening.

- This may be difficult to assess with vegetative cover in place. With this in mind, 20% would be more realistic than 10%. Also add a statement, "unless authorized by the LCRC".

- In the Green Area development often involves construction of long accesses across terrain which will not support traffic other than during the winter. This means roadbeds and service area on the wellsite must be improved with gravel, large coarse fragments, or similar materials. During reclamation for abandonment, it will be impossible to achieve the 10 percent increase in coarse fragments in surface cover without importing large quantities of gravel-free or stone-free soil. We recommend that the percentage increase in coarse fragments in surface cover be increased to 20, e.g., if the control has 5 percent cover, the improved access and service area of the wellsite may have up to 25 percent cover, the maximum allowed under any circumstance. Unimproved sections will still be restricted to 10 percent increase in coarse fragments.

- There is a need to standardize requirement based on land use (present and future) rather than ownership and whether the land is cultivated or not (i.e. Red Deer example: "rocks are going to roll" from private lands to public lands on sites constructed on the boundary line).

Industry Responses:

- No accurate measuring technique. Delete need to estimate volumes of different size classes. Better definition required. Differentiate between tiers.

- Coarse fragments should be 10% better than controls. Remove coarse fragments from topsoil/surface soil.

- Same as adjacent lands.

- No accurate way to measure this, therefore drop the need to estimate volumes of different size classes. Differentiate between the cultivated and non-cultivated, i.e. this is not appropriate for newly cultivated lands.

- Private land - if less than or equal to 10cm in diameter allow up to 20% increase. Cultivated public land - an increase in 20% in surface cover. Non-cultivated public land - has not seen a hay or cereal crop - coarse fragments should be exempt.

- Need not be included as it is covered under the topsoil category.

- Should be restricted to plough depth - minimal fragments should be allowed.

- No accurate way of measuring this, therefore drop the need to estimate volumes of different size classes. Differentiate between the 2 tiers, cultivated and non-cultivated (this may not be appropriate for non-cultivated lands). Better definition for coarse fragments (lower size limit).

- Private land - if less than or equal to 10cm in diameter, an increase of 20% instead of 10%. Public land (cultivated) - if less than or equal to 10 cm in diameter an increase of 20% instead of 10%. Public land (non-cultivated - has not seen a hay or cereal crop - should not be an issue.

- This measurement system is a deviation from both the Soil Quality Criteria and the Land Capability Classification system. What is the basis for the parameters chosen and where did it come from? It is too limiting. What is the justification for the division between private and public lands? The division of private land and public land is not consistent throughout the document.

- % and size of coarse fragments subject to interpretation of reclamation inspector vs company inspector.

Stakeholder Responses:

- Criteria needs to be the same for both private and public land.

Consultant Responses:

- This criteria tends to be relatively subjective and is debatable as to each individual's assessment.

- To match surrounding land get rid of less than 10cm and more than 10cm percent coarse fragments. Need only a statement, "Coarse fragments should be the same as control, on surface, in plow layer and below plow layer (operator does not haul in new rock)".

- Good/Satisfactory/Acceptable: Government (7 responses), Industry (2 responses), Consultants (1 response).

CRITERIA PACKAGE - LEVEL I
LANDSCAPE - DEBRIS

Government Responses:

- Would rather woody debris left on surface rather than encourage burial.
- If bushland, not all roots and slash require picking - enough for farmer to control weeds. In Green Zone roots/ slash favorable for erosion control.
- Examples of industry/domestic debris?
- Is abandoned pipeline left in situ considered debris?
- Specifically state that burial of woody debris is unacceptable.

Industry Responses:

- Cleaned up or not.
- Retain ability to bury cement onsite with minimum 1.2m of cover. Woody debris (roots/slash) should be used for erosion control or spread on site on non-cultivated public land. Small roots and slash should be allowed on areas where predisturbance consisted of brush or tree cover. No fire hazard - no authorization required.
- "Debris" definition? How will this affect procedures such as roll-back?
- Natural debris an asset on Green Area sites as it prevents traffic and erosion.
- Define "debris", i.e. roots and twigs, woody debris - acceptable limits.

Consultant Responses:

- To match surrounding land remove industrial debris down to the size of acceptable coarse fragments.
- Good/Satisfactory/Acceptable: Government (14 responses), Industry (5 responses), Stakeholders (2 responses), Consultants (2 responses).

CRITERIA PACKAGE - LEVEL I
TOPSOIL DEFINITION

Government Responses:

- When muskegs are padded over, it is unlikely that fibric materials would be salvaged and replaced on top of the pad. Mesic and humic material would be since it would aid revegetation. Confusion in forest areas (by industry) using Ae as topsoil (understripping problem). More education on luvisols.
- Need simple definition supported by a footnote description of various settings.
- Private lands and crown lands should be treated under two separate criteria.
- Good. Also illustrate schematically.
- Ae material should not be considered where Ah is greater than 20cm.
- For non-cultivated luvisols, the definition should cover the A, AB and some of the Bt as is necessary to provide a good workable Ap.
- Definition is fine. On cultivated lands give thought mixing Ae with Ap, some cases may not have a positive affect.
- Excludes several soils on private land. Topsoil definitions should be by soil type and not ownership. Brunisols have been excluded by the definition.

- Require clarification on Ae and AB horizons. Is Ae and AB topsoil or not?

- May not apply in all cases.

- One of the first tasks in the workshop should be to agree upon soil definitions. 1) Information about organic layers should be expanded, e.g. when salvage should occur and types of layers to be salvaged (humic, mesic, fibric). 2) Confusion in forest areas as to how Ae horizon should be salvaged.

Industry Responses:

- Simplify for the equipment operators.

- Original stripping determines this. Use common definition for all people. Should include A, B and C horizons.

- Simplify definition for operators.

- Upper layer of organic soil.

- Subject to interpretation. Assumes all inspectors have soil sciences degree.

- Although the definition of topsoil is clear and well defined for private land and cultivated public land, it is not correct. Horizons such as Ae, AB, LFH, Of, Oh and Om should not be considered topsoil. For example, an Ae horizon is not desirable topsoil and AB horizon is a transitional horizon.

Consultant Responses:

- Definition acceptable but access roads should be assessed differently. On developed roads which have been reclaimed, check across the right of way to ensure shoulders acceptable as compared to the middle. Fewer sample points (50m - 75m spacing) that yield good information more valuable than many that mean nothing. Examine landscape on access road assessments.

- Simplify so construction foremen can do the description and documentation.

- With peaty gleysols by adding the organic with the underlying Ah, Ahe, etc. excessive topsoil depths are created. Plus the organics under the right conditions will break down faster, decreasing combined topsoil depth.

- Good/Satisfactory/Acceptable: Government (8 responses), Industry (3 responses), Stakeholders (2 responses).

CRITERIA PACKAGE - LEVEL I
SURFACE SOIL DEFINITION

Government Responses:

- What is or who declares what "specific depth of soil to be salvaged" is?

- Should be reworded to define better in terms of horizons (A and B) and reasons for using, e.g. very thin. A horizons or good quality of B horizon (in some forested areas). Surface soil depth should be related to something definable, i.e. the control rather than companies waiting for the Reclamation Inspector to specify.

- For non-arable soils, I would suggest at least 30 cm of mineral soil (if available) or all soil if bedrock is closer to the surface. On gravel soils they should 2 lift (the sod and the organically enriched layers).

- What parameters are used to access surface soil for quality (define).

- I see no value in this term, creates unnecessary confusion. Topsoil is topsoil, if we want to allow overstripping into the B simply say so.

- Creates a double standard between public and private. It should be very specific as to what type of soils are considered surface soils. Land use should not be the determining factor.

- Do not like this as it should be better defined as topsoil or something more descriptive than surface soil.

- Should be removed. Call everything topsoil. Specific topsoil horizons (i.e., Ah and Ap) usually have a defined depth on a specific location. Based on this assumption, topsoil can still be described/defined by depth (based on horizon depth and not a predetermined depth picked at random).

- Assessments will vary depending on soil class and variable topsoil depths.

- How do we assess? Can we approve mixing based on shallow A as control where deeper stripping is appropriate.

- The definition should be reworded to better define in terms of surface mineral and organic horizons and should be related to something definable, i.e. the control. Reasons for using the surface soil definition need to be cited.

Industry Responses:

- Why is it needed? Drop this definition and have one topsoil definition.

- Need more clarification.

- Delete this definition and have one topsoil definition.

- Interpret surface soil to mean not separating horizons, but to strip and replace as a mixture. Organic soils should not have to salvage if organic soils are deeper than 30cm.

- Immediate root zone.

- Delete. Have one topsoil definition.

- Subject to interpretation of inspector. Assumes that all inspectors have a degree in soil sciences.

Consultant Responses:

- Same as with topsoil.

- Good/Satisfactory/Acceptable: Government (7 responses), Industry (2 responses), Stakeholders (2 responses), Consultants (1 response).

CRITERIA PACKAGE - LEVEL I
TOPSOIL/SURFACE SOIL SAMPLING SCHEME

- Many staff think that 25 locations/ha is too rigorous for uncultivated lands. 10 locations/ha is adequate, unless the landscape is very diverse.

- Call it "Topsoil/Surface Soil Assessment Scheme".

- We may want more sampling where we have diverse topography. The need for additional site locations should be referenced.

- The 25 sample locations per hectare is excessive. I have used 25 per wellsite and found those to be comprehensive enough.

- This may be a little overkill, in particular in the forested crown land destined for tree production.

- The 5 x 5 may be too intensive unless there are problem areas. 4 x 4 spacing may be appropriate for non problematic (newer) sites.

- What parameters are used in assessing surface soil?

- No concerns with the grid. In addition to the grid, soil sampling should be conducted in the soil storage areas.

■ Would prefer a system where after an initial sampling, say 25 plots, if conditions were either very good or very poor you would be done, but if the results landed in the middle ground that would trigger a doubling of the sample intensity (either for the entire site or problem area). Also a standard worksheet must be provided.

■ The 25 samples onsite may be a bit excessive for sites where crop/vegetation is uniform and comparable to offsite. What about scientific error in measuring?

■ Statistically it has been proven for larger sites (greater than 0.5 ha) 25 samples is the ideal number of sites required to give confident information about a location. Less than 25 samples reduces your confidence level. More than 25 samples increases your confidence level but by a proportionately insignificant amount. Allowing industry to have less than 25 sample locations will only reduce their confidence level on the wellsite Reclamation application and therefore likely increase the LCRC's workload as a result of increased failures and more return trips to locations.

■ Topsoil OK. Surface soil -comparison?

■ Generally staff accept 25 samples for land under cultivation. However, some think that sampling density should be reduced on cultivated lands. The samples should cover well centre, sump, flare pit, work area and lease perimeter.

■ Our field officers have some problems with this category of criteria. We wish to see the separation between uncultivated public lands (Green Area), and private and cultivated land retained primarily because of land use differences in the two areas. Surface soil is defined in the criteria document as "a specific depth of soil to be salvaged and replaced" on uncultivated public land. The confusion relates to which horizons and how much (thickness/depth) of these horizons must be salvaged. In the Green Area a minimum of the surface soil to be salvaged is 15cm, which would be the normal plow depth if the site were under cultivation. This normally represents the A horizon. Where the A horizon is very thin, the Ae, AB, and even parts of the B or C horizons may be salvaged in order to achieve the 15cm minimum. The LFH, where present, should be incorporated with the surface soil. In assessing sites for replaced surface soil depth comparison with the controls, the assessed depth will be based on 70 percent of the total thickness of the materials expected to have been salvaged. Where the soil happens to be organic, the assessment depth will be to a total depth of 40cm if the site was not upgraded to handle traffic; if upgraded, the assessment will be to 15cm. In order to cut down on the time it takes to assess a site, the individual assessment points could be reduced from 25 to 10 or 15 points per hectare. We do not believe this will significantly affect the estimated average depth of surface soil on the lease for comparison with the control, even taking into consideration the natural variability in undisturbed forest soils. A minimum of four control points per site should not change.

Industry Responses:

■ Differentiate between tiers: cultivated = reduce to a minimum 10 sample points; non-cultivated - pasture = 10 points. Green zone = new criteria required.

■ The 20m x 20m grid is too intensive. May expand to 30m x 30m in most cases.

■ OK for private land, but public land and lower class soils could be down to 10 to 15 sampling points. Forested lands should be judged on capability and productivity only.

■ No sampling required on unused portions. Fewer per location required.

■ The 25 assessment points are quite a few. 8 to 10 would be more reasonable.

■ Sampling density proposed (20m x 20m) is unreasonable - would require 36 assessment points for an average 120m x 120m lease. Time and cost necessary to dig test pits and record soil characteristics will be prohibitive.

- Differentiate between the two tiers: Cultivated - reduce to a minimum of 10 points. Non-cultivated - pasture 10 points, green zone new criteria required with fewer points. Apply principle of "number of points required to characterize the site" i.e. floating sample number (not predetermined).

- A 9 point sampling grid is sufficient for most leases.

- Differentiate between the two tiers:- Cultivated = reduce to a minimum of 10 points, Non-cultivated -Pasture = 10 points, Green Zone = new criteria required. Apply principle of "number of points required to characterize the site.", i.e. floating sample number.

- Wellsite - sample on a 30m x 30m grid. If a problem is identified increase the sampling points at problem area. Access road, private land or public land - cultivated - sample points every 100m. Public land - non cultivated (never seen a hay or cereal crop) and improved pasture every 250m. Unimproved land (timber): a) if a road grade was built every 250m, b) if a road grade was not built (winter access) it is not required.

- Not practical to sample on locations where pads will be left in place, muskeg areas or locations where low areas have been filled. Problems exist where topsoil conservation was not practised on 40 year old locations.

- Change to a 30m x 30m grid. If a problem is identified increase the sampling points in the problem area to identify nature and extent.

Consultant Responses:

- Acceptable as defined. We have found that the procedure provides an excellent review of the site and when completed the assessor really has a good idea of site conditions.

- Too much sampling called for and too restrictive on variance and admixing.

- For private land I feel 25 is too many.

- Good/Satisfactory/Acceptable: Government (7 responses), Industry (1 response), Stakeholders (2 responses).

CRITERIA PACKAGE - LEVEL I
ACCESS ROAD SAMPLING SCHEME

Government Responses:

- Varying opinions - on shorter accesses on public land (up to 1 mile) 100m apart would be better. On very long access may want to spot check on areas where revegetation is poor.

- Uniform landscapes may require less assessments, but this must be carefully evaluated. Should be "Access Road Assessment Scheme".

- This may be a little overkill, in particular in the forested crown land destined for tree production.

- 30m intervals is excessive. Every 50m would be preferable particularly on long access roads. The paired concept is necessary.

- Fewer samples could be taken and would be still representative being that roads are linear and are impacted the same throughout their length.

- Allowances should be given for existing trails or seismic lines that have been utilized (Green Zone or undeveloped lands) and are returned to their original conditions, but not the same condition as the control. In these cases the neighboring lands make an unfair control.

- Per previous comments especially for diverse sites. For long roads on level fields, wider spacing will be required.

- Good distribution but if problems are evident, key in on problem areas.

- Sampling methodology should be the same for every site with no exceptions for public lands. Companies could be given some flexibility for long access roads on flat land or where there was no stripping versus a production site with a high grade gravel road.

- Every 30m is a bit excessive on long access roads, where crop/vegetation indicates uniform and comparable topsoils with offsite.

- Recommend sampling be done every 50 to 75 m unless highly diverse landscape exists.

- Should be consistent on all lands (i.e. wellsites on cultivated lands can have a long access as well).

- Too rigid. Random sampling should be allowed on long access roads. If access not disturbed (grassland) no samples should be required.

- Sample anomalies as opposed to rigid spacing.

- Every 30m/250m may be close dependent upon situation. Flexibility must be maintained - stress companies responsibility to ensure comparability.

- Develop sampling requirements for different types of access, e.g. 1) understripped native vegetation = none required, 2) stripped (bladed)= every 100 metres - on long accesses (define) concentrated random sampling where revegetation is poor, 3) graded = every 50 metres.

Industry Responses:

- Eliminate sampling on non-disturbed areas (i.e. winter trails.) Cultivated = reduce to every 100m. Non-cultivated - pasture = every 250m. Green Zone = new criteria required.

- Every 30m is too intensive. Typical 400m access would require 13 samples and 13 controls. Should be expanded to one sample and one control every 100m.

- Needs to be more adapted to a site specific circumstance, i.e. we sampled only 100m or 200m intervals because of these reasons.

- Fewer per access. Differentiate from cultivated, pasture, White and Green Zones.

- Sampling density proposed for cultivated public land and private land (paired every 30m) may be prohibitive for long access roads. Even a 500m access road would require about 30 assessment points. Time and cost necessary to dig test pits and record soil characteristics will be prohibitive.

- No sampling required on non-disturbed areas, i.e. winter trails. Differentiate between tiers: cultivated - reduce to every 100m; green zone - new criteria with fewer sample points.

- Interval should be based on topography and soil conditions. Guidelines could be as follows: private land or cultivated public land - sample point every 75m. Non-cultivated public land (never seen hay or cereal crop) - improved pasture every 150m, unimproved land (brush or tree cover) and if a road grade was built - every 250m. If road grade not built (winter access) no sample points required.

- No sampling required on nondisturbed areas, i.e. winter trails. Differentiate between tiers: Cultivated - reduce to every 100m. Non-cultivated - Pasture - every 250m. Green Zone - needs new criteria.

- Not necessary to sample cut-lines in Green areas where access was during winter months only.

Consultant Responses:

- Too much sampling called for and too restrictive on variance and admixing.

- Access roads should be assessed differently. On developed roads which have been reclaimed, check across right of way with points to ensure the shoulders are acceptable as compared to the middle. Fewer samples taken at 50 - 75m spacing that yield good information are more valuable.

- For private land, again every 30m seems excessive.

- Good/Satisfactory/Acceptable: Government (4 responses), Industry (2 responses), Stakeholders (1 response).

CRITERIA PACKAGE - LEVEL I
ACCESS ROAD SAMPLING SCHEME

Government Responses:

- Explanation required for cases where conditions prior to construction not known. Should be more than 4 control sites as minimum. Suggest same grid be done prior to construction on new sites and at least 4 per side on wellsites where offsite controls necessary.

- Four controls are inadequate to provide a comparison when site variability is great. Suggest that pre-construction controls be an option where control variability (offsite) is likely to be extreme (e.g. fibrisol more than 100cm deep, to gleysol with thin Ah to luvisol with trace Ah and an Ae of 15cm). Cannot always determine an average control depth of topsoil/surface soil.

- Should be "Control Site Assessment Scheme".

- This may not be enough. It is in the company's best interest to prove variable soil depths.

- More control sites will be required for diverse topography (i.e. on side-hill slopes 3 or 4 per side slope on each side of the wellsite).

- Only 4 controls is insufficient, 8 is preferable.

- Increase intensity to two per side.

- May require more than four control sites if topography is highly varied.

- Satisfactory. Have to address the issue of offsite control sampling by Industry if landowner disputes should arise. Address trespass issue.

- The minimum of four samples is acceptable. Variability on public land can be pronounced. It is expected that companies will have to sample more than four control locations in many cases, to provide a reasonable comparison to on-site data. Where offsite variability is extreme, allow an option of pre-construction controls (onsite).

Industry Responses:

- Access - too many controls. Do we need to change texture, depth, etc. every 30m when reclaiming road?

- As required only.

- Minimum of 4. More if topography dictates.

- Control sites are trespassing. Refusal by landowner should be acknowledged by government inquiry.

- Public land should not require as many sample points. Inspections should not result in failure of a site based on failure of 1 sample at 1 control.

Consultant Responses:

- Use of offsite immediate adjacent and nearby adjacent acceptable.

- This should be waived if a pre-construction assessment was done.

- Good/Satisfactory/Acceptable: Government (10 responses), Industry (5 responses), Stakeholders (1 response), Consultants (1 response).

CRITERIA PACKAGE - LEVEL I
TOPSOIL/SURFACE SOIL QUANTITY

[A]. % AVERAGE DEPTH REPLACEMENT
[B]. NUMBER OF SITES ALLOWED TO HAVE LESS SOIL THAN AVERAGE

Government Responses:

- [A]. OK. What about sites constructed before 1983?

- We run into problems on some farm development leases where topsoil quality has to be evaluated according to the criteria for cultivated land. For example, a wellsite constructed in the Alliance area in 1989 would have failed on the basis of topsoil depth. Control topsoil depths were highly variable, ranging from 5-12" with an average of 9". Replaced topsoil depth ranged from 2-12", with an average of 8". According to the criteria, average replaced topsoil depth for sites constructed from 1983 to 1992 has to be 80% of control. This site passed that criterion, however, only 50% of the sample sites were more than or equal to 80% of the average replaced depth onsite (instead of the required 90%) and one sample site was less than 50% of the average replaced depth (100% must be greater than or equal to 50% of the average replaced depth to pass). Given the variability of controls should this site be failed? This site was not being cropped annually - it was seeded down to pasture. Public land is generally not as suited for cultivation as private land - there is often considerable natural variability in topsoil depth due to topography. More variability in topsoil depth on reclaimed areas can be acceptable. Section should be reworked to simplify and prevent inconsistency and inaccurate assessment.

- Graph to show relationship. [A]. All sites should have a depth within an allowable range. 9+ certainly is not much extra work to distribute materials in such a way that all sites fall within allowable greater than or equal to 80% of ARD, so why not do it, and avoid potential problems associated with a central area with little topsoil.

- [B]. May be circumstances where this may not be practical. Site specific situations may be a field call.

- [B]. Where cultivation practiced, if the control has soil depths exceeding "depth of cultivation" then all replaced depths must exceed that otherwise a potential for long term soil mixing.

- [A]. The average % replacement depth is acceptable. Necessary to maintain high standards to ensure the best job possible. [B]. Appears industry is having difficulty achieving this criteria. . . even topsoil distribution failed on many sites I assessed in 1993.

- On shallow topsoil horizon, standards are very difficult to attain, impossible in frozen conditions, i.e. % admixing.

- [A]. How much admixing and resulting increase in depth is acceptable? We need a consistent approach as to how we measure the depth of an admixed soil compared to the control, i.e. with 20% admixing we only count 20% of the measured depth. [B]. Rather than number of sites, a % of the area over depth, i.e. 90% of the area must have 80% of average depth. Example, minimum number of plots set at 25, each plot represents 4% of the site. If problems, company could double number of plots (50) thus each plot would represent 2% and if site still failed, would have better idea of the extent of the problem.

- [A]. Concerned that we may have given up too much on pre-1983 sites. Distribution standard does not have an upper limit. [B]. The limit should be zero. All sites should not exceed the distribution parameters. Needs to be simplified - parameters should have upper/lower limit, i.e. xx% of control ±20%. Problem with distribution on non-cultivated public lands.

- [A]. Will be difficult to achieve 90%, 80%, 70%, 50% of control in areas with thin topsoil constructed in winter.

- [A]. Equal to control ±10%. [B]. 1 only with a significant variation.

■ [A]. May be difficult to achieve 90%, considering construction equipment has not evolved to keep pace with this requirement. [B]. Should be written in plain language to remove the misinterpretation found to occur within industry. Remove variance with Public Lands on non-cultivated land.

■ [A]. Does industry and government have the right to determine an acceptable loss of topsoil on lands that are privately owned? The argument to reduce the 90% standard to something less is unacceptable because there is no proof to support that the 90% level for 1993 or later wellsite construction can or cannot be met. Until conclusive research proves what actual losses are incurred under wise management of construction, can we determine what the acceptable percentage will be? [B]. Once industry understands the quantity requirements, they can be constantly monitoring replaced topsoil depth during abandonment. Allowing sites to have less soil than average, in my opinion, allows industry to be a little more sloppy in topsoil replacement during abandonment than they would normally be without this concession.

■ OK but may be hard to work with on some soil types.

■ Too strict. [A]. difficult to attain on shallow topsoil depths. Both on and off have to be 100% to accurately measure. [B]. Should allow for normal cultivation to distribute in reasonable time.

■ Should possibly refer to winter conditions and it is company's decision to drill during this time. Intent is not to relax criteria for adverse conditions. 1. Is 90% realistic? For non-cultivated public land is 70% realistic? Should also reference quality as depths are dependent upon for assessment purposes.

■ It is suggested that modified requirements be developed that are the same for topsoil/surface soils: a) new sites: 80% of control or "surface root zone" b) 1983-1992: minimum of 60%, or base on disposition conditions (public land) and site specific concerns c) pre-1983: use vegetation criteria, disposition conditions (public land) and consider site specific concerns. Note: On native prairie/sensitive areas that should not be redisturbed, a vegetation criteria "over-ride" is required. It has been suggested that 80% of sample sites must meet 80% of average equivalent soil depth on the control. 100% of sites must be greater than 40% of average equivalent control soil depth. This section of the criteria needs to be reworked to simplify and to prevent inconsistency and inaccurate assessment.

■ The average replacement soil depth of 70 percent or greater, as compared with the control, makes adequate room for winter operational problems (the soil tends to break up at frost line), and the fact that no heavy equipment does a perfect job at restripping and spreading soil evenly. This depth requirement is easy to achieve considering even the operational problems; we therefore propose that this remain the only criterion for surface soil quantity. To be consistent, we now propose the "depth stated in the disposition" or as "specified in writing by the Conservation and Reclamation Council" be dropped for the Green Area.

Industry Responses:

■ Criteria OK prior to 1983. Criteria from 1983 to present: cultivated = 80% of control or a minimum of 25cm; date of construction not as important as land use, site history, etc.; non-cultivated = needs new criteria, allow for natural variation of topsoil distribution.

■ Allowance should be made for older sites that have been reclaimed and are showing ;good recovery yet do not pass this criteria.

■ [A]. 1993 or later should be 80%. 1983-1992 needs to be broken down into more different year groups.

■ [A]. Should be 80% (influenced by season work done in). Must have variances as not all original land consistent topsoil depths.

■ [A]. Reasonable consideration should be used. [B]. Comparable to "control site" deviations.

■ [A]. Will not be possible to meet % average depth of replacement on many older sites. We have many sites dating back as far as the 1930's where topsoil was not conserved. Finding additional sources of topsoil is becoming increasingly difficult and expensive.

■ [A]. Cultivated - revise minimum soil quantity recovered to 75% of control or a minimum of 25cm as of 1992. Tie to other parameters than just date of construction, i.e., land use, site history. Non-cultivated - require new, less stringent criteria. Allow for natural variation of topsoil definition.

■ [A]. Is OK if change sampling points to every 30m, otherwise it is too harsh. [B]. Based on the fact that every time you handle topsoil you lose approx. 10%, the required average replaced depth should be 80% of control or original for 1993 onward, and 70% for sites constructed prior to 1993. Class 5 and 6 land OK except there should be some allowance for Class 4 lands which are in an area of significant Class 5 & 6 lands.

■ [A]. Concerned that there does not appear to be any flexibility by AEP with respect to topsoil requirements on leases which are already supporting adequate vegetation. AEP personnel have required destruction of existing vegetation for the redistribution of "acceptable" topsoil profiles. [B]. A grandfathering clause should be considered for wellsites reclaimed prior to the issuance of AEP's "Wellsite Reclamation Criteria".

■ [A]. Assessing quantity is difficult where shallow topsoil is encountered (e.g. determining 70, 80 or 90% ;of 2.5 inches of topsoil is very subjective).

■ [A]. Cultivated - revise maximum soil quantity recovered to 80% of control or a minimum of 25cm as of 1992. It is generally felt that 80% is the absolute maximum that might be recovered during winter construction. Even this target may not be achievable. [B]. Consider other parameters than just date of construction. i.e. land use, site history. Non-cultivated requires new criteria. Allow for natural variation of topsoil distribution, i.e. the range of topsoil depths observed in the controls should be allowed for on the wellsite.

■ [A]. Can live with amount % if admixing is changed.

■ [A].What is the original of the topsoil depth values for private land and cultivated public land, where were they developed, and what is the justification behind them? They are very unrealistic, allowing for a loss of only one cm of topsoil when 10cm has been removed (new projects constructed after 1993). Also, it is impossible to expect a 50% replacement of topsoil when topsoil was not required to be salvaged before 1983. Topsoil cannot always be hauled in. The idea of "grandfathering" a site through the years of different construction techniques ;is very suitable but it must be based on realistic objectives. The idea of applying the CLI classes is a good. one. Can we not approach all areas in this manner?

■ [A]. % average depth replacement. Subject to interpretation of inspector, may vary 50% or more between inspectors. [B]. Number of sites allowed to have less soil than average - should be decided based on capability of site to maintain an equivalent crop (i.e. 20 inches vs 25 inches of topsoil).

■ [A]. For the average replaced topsoil depth it is difficult to believe 90% is attainable; ideal conditions are needed. Winter construction, frost? Suggest that 80% is more realistic for 1993 onwards. Sites prior to 1983 need discussion: If new material is brought in that is different than control (i.e., texture), it will fail criteria. Topsoil availability is getting to be a bigger issue/problem every year. Topsoil versus surface soil: need to allow alternative material (other than Ah, Ap) to be used at surface (addition of amendments, old revegetated spoil piles). Topsoil replacement

continued . . .

alternatives are not addressed by this document. This document seems to assume that topsoil is always readily available from somewhere. For many older sites, topsoil will be in short supply, and borrowing it from other areas is considered to be inappropriate, if not impossible. Amoco believes this is a very difficult subject and is a very significant item that needs to be addressed in the context of these reclamation criteria. The section "Site Data" of the application form has at least one item (e.g. Dominant Soil Order) that is not relevant to the nature of the Level I assessment required to complete the application. There needs to be clarification on Alberta Environment's expectation of who would complete the draft application. Presently, we are left with the impression that a "soils expert" is required in order to complete this application properly. This conflicts with statements Larry Brocke made during the CAPP Reclamation Conference.

Consultant Responses:

- Acceptable as listed. [A]. The quantity of soil replaced may be difficult to attain under winter conditions in areas of the province where topsoil is deficient or in poor conditions.

- [A]. Too restrictive and too many sample points per hectare. [B]. Too restrictive and too many sampling points per hectare. Make more practical for field measurement and definition.

- If gleysol problem described previously . . .[A]. Has to be some leeway here, especially if we're at the boundary of 20% of average. [B]. This has got nothing to do with "equivalent land capability" if one, 2 or 3 sites are not at 20% of the average.

- Good/Satisfactory/Acceptable: For Question [A] - Government (4 responses), Industry (1 response), Stakeholders (1 response). For Question [B] - Government (4 responses), Industry (2 responses), Stakeholders (1 response).

CRITERIA PACKAGE - LEVEL I
TOPSOIL QUALITY - MEASUREMENT METHODS

[A]. % ADMIXING
[B]. TEXTURE TRIANGLE
[C]. AGGREGATE SIZE
[D]. AGGREGATE STRENGTH
[E]. LAYERING

Government Responses:

- [E]. Some inconsistency between criteria and drilling waste guidelines (farming).

- Some quality criteria should be implemented for newly constructed sites on uncultivated public land. Too rigorous. Site should not necessarily fail because of one failure of one parameter at one assessment point. Classes quite subjective. [A]. 20% admixing on a cultivated site is common - 30% could probably be allowed. Suggest implementing upper limit for admixing on uncultivated public land, e.g. 50%. [E]. Categories are too subjective - suggest that there be 2 categories based on whether layering is/is not affecting plant growth.

- Similar depths, density, etc. using the same measurement tool as in others. [A]. "No more than 20% non-topsoil materials in replaced topsoil sample control". [B]. Must be revised to correspond to triangle commonly used and accepted in Canada. [C,D and E]. OK for now. May need to be modified at a later date. There will be some confusion at first.

■ [A]. Admixing is very difficult to call, especially to 20%. The figure of 20% will not have an impact in grey soils, however, it can have a great impact in saline soils. The whole process is very subjective and open to argument unless you have numbers to back you up. [C]. Layering you can see visually, however, to what degree is of significance, i.e. 1", 2" of topsoil.

■ [B]. Replace triangle with correct one.

■ [A]. This must be revised to address the replaced depth factor. If the company replaces the 80% (just) and has any admixing, we have automatic failure. [C]. Explanation required for improvements

■ [A]. I have used this technique but still have difficulty with determining % admixing. [B]. Difficulty in determining this criteria. [E]. Believe this is commonly confused with compaction.

■ Very difficult to meet % topsoil replacement and quality on soils with thin topsoils or on sites developed under frozen conditions. [A]. 20 % admixing is difficult to estimate on brown soils. [C]. Difficult to be consistent with others on texturing of soil. [D]. Estimation of aggregate strength and size would be inconsistent among different people and companies.

■ All we have are our shovels, probes and eyes, anything available that would provide us with a more scientific approach would be appreciated. [A]. This is unclear, 20%, does this mean that 20% of 10cm of topsoil can have admixing or will the depth have to be 12cm with 20% admixing to be equivalent to a control of 10cm. [C, D and E]. Terminology should be consistent. Satisfactory, but in my mind aggregate means gravel, I think particle would be a better word.

■ [B]. Too general. [E]. May be discontinued.

■ [A]. 20% admixing may be excessive in some soils and have little or no effect in other soils. [B]. Should be replaced with the Level II triangle. [C and D]. No concerns. [E]. A definition is required and definition for the classes.

■ [A]. Difficult to assess based on visual observation, % error and difficult to achieve 20% in many winter operations. [B, C, D and E]. Agree.

■ [A]. Difficult to properly evaluate. [B]. Difficult for everyone to be standard.

■ [A]. It is very difficult to remove all the topsoil without admixing some of the "B" horizon. Should we accept more B material in the topsoil that C material? Subsoil should be defined as to upper B and lower (C) horizons. [B]. Change to conform with standard triangle. [C]. No comment. [E]. Needs further clarification.

■ Good overall, unfortunate % organic matter could not be measured by some method other than lab analysis because it would greatly improve decision making (pass/fail). [A]. Requires clarification, difficult to measure, creates complication with topsoil quantity requirements. [B]. Very poor choice under Level I, should use actual textural triangle as published by the Canadian System of Soil Classification or textural triangle proposed by Arnold Janz based on key soil parameters. [C]. Requires clarification - often confused with soil horizons and platy structure (Ae layer). Evident versus obvious difference in extent needs to be reworded using terms that are more quantifiable. [E]. Under Level II - Aggregate Structure has been included. Should it not also be included under Level I in this section?

■ [A]. Hard to assess accurately in some soils. [D]. Too specific.

■ [A]. Difficult to determine. [E]. OK. Tough to compare disturbed to undisturbed.

■ We propose that no changes which affect the Green Area be made. We don't propose at any time that topsoil must be trucked to be spread on the site. For situations in the Green Area, that expectation will almost always mean issuing another lease for topsoil extraction. We wish to avoid such a situation. If amendments are needed to improve the growth medium at a site, we encourage their use. (We do not intend to stop operators from trucking topsoil if they wish).

■ Define what is acceptable as a representative control. Most staff agree that there should be more tolerant soil quality criteria for new wellsites on public land. A vegetation criteria "over-ride" will be required for native prairie and other sensitive areas that should not be redisturbed. [A]. On new construction, staff think that less than 20% admixing is acceptable for all land types. On old cultivated sites on public land less than 50% is acceptable. On old wellsites on uncultivated public land, the vegetation criteria will be used. [B]. Staff prefer the simpler version of the texture triangle. [D]. Since changes in aggregate strength relate back to admixing, compaction or contaminants, some staff think this criterion is repetitive. [E]. The effects of layering are best measured by plant root growth: layering either inhibits root growth or it doesn't.

Industry Responses:

■ [A]. Admixing % is not very accurate nor does it appear to consider capability - delete it. [C]. If texture and structure does not change, admixing is a non-issue. [F]. Better define layering.

■ Graduated scale required for older sites. [A]. 20% has been found difficult to achieve particularly on reclamation of sites prepared in winter. Sites with greater than 20% admixing have been seen to suffer no significant adverse effects. It is prohibitive requiring all assessment points to pass for site pass. Should required 70 to 80% for site pass.

■ [A]. Throw this out, if site is as productive as offsite and passes all other parameters, admixing should not matter especially if ;site was two lift stripped. [E]. Remove this as it is already checked, as in no drilling mud, no change of texture, compaction, etc. or change the definition of layering so we all agree what it is.

■ [A]. This must be compared to land use and end production. [C]. No need for sizes. [E]. Should not be a factor if horizons replaced properly.

■ [A]. No accurate way of measuring admixing - delete. [C]. If texture and structure no change, admixing non-issue. [E]. Define layering.

■ [A]. The majority of sites will fail on % admixing. This is particularly true for older sites or sites that have been regraded at various times. Topsoil/subsoil admixing is extremely difficult to correct once it has occurred. Unless a satisfactory solution to admixing problems can be identified, the 20% admixing limit should be relaxed.

■ Require the use of a spade rather than sampling tube for measurement. [A]. Eliminate admixing as it is already addressed by texture and structure. If it is not to be eliminated, then change to 40% for winter construction and 30% for summer construction. [B]. Use the texture triangle in the CanSIS manual. [E]. Eliminate layering or define more clearly.

■ [A]. Determining admixing percentages is extremely difficult, i.e. is a very subjective call. We found variances from 15-45%. Admixing is more prominent where shallow topsoil or surface soils are present. Both lease stripping and respreading of topsoil inevitably cause mixing. Farming practices result in admixing which is not as apparent.

■ [A]. Proposed 20% admixing should be attainable. [B]. Fairly general. [C]. Must be flexibility in aggregate size. [D]. Friability important reclamation indicator - soil aggregate strength very important. [E]. Layering could have several interpretations - in my opinion layering goes along with compaction, could be layering of foreign material. Perhaps this should be clarified.

■ [A]. No accurate way of measuring admixing - delete. Use only texture and structure evaluations. If there is no change in these parameters, admixing is a non issue. [E]. Clarify definition of layering.

■ [A]. Admixing of subsoil very subjective. Drop the admixing criteria and replace with no change to structure or texture. If admixing cannot be dropped then change to 40% for winter construction or prior to 1983, and 30% for summer construction or after 1983.

- How will each of the soil quality items be measured as no noticeable differences between the site and a control is at the discretion of the inspector? As an example, is no noticeable loss of soil darkness defined as a change in one color class or five color classes? A 0% change in soil texture can be difficult to maintain once a site has been disturbed, especially if one is near the boundary for a particular texture. Also, an increase in sand or clay content may be a positive influence depending on soil type. A change in aggregate shape and orientation refers more to subsoil characteristics than to topsoil. How will this be assessed and by whom?

- Subject to interpretation of inspector, may vary 50% or more between inspectors. Analysis based on only one sample per $20m^2$. Green area and White area locations should not require as extensive a grid as private lands. [A]. Subject to interpretation of inspector, sites being failed due to admixing when it is not hampering equivalent capability for production of crops. [C]. Subject to interpretation of inspector. [D]. Subject to interpretation of inspector. [E]. Subject to interpretation of inspector. In some cases, consideration not given to equivalent growth capability of lease vs immediate surrounding area.

- What about older sites? A breakdown is needed (1993 on, 1983-1993, prior to 1983). Need to allow room for justification and revegetation success; soil reconstruction for older sites. Need clarification.

Consultant Responses:

- [A]. Admixing must be assessed on a site by site basis as well as according to the criteria. The objectives should be as stated but if crop productivity is not affected, the Reclamation Officers should be allowed some leeway to use judgement and field experience.

- Sampling points can be reduced if when sampling a few points (8) across the lease and they are OK, why do more? [A]. 20% may be restrictive, say 40% at 10cm to 20% at surface. The requirement of 20% or 25% seems fair but once it is exceeded how do you make it better? [B]. OK, but I rely on soil analysis, % sand, silt and clay. [C]. OK as long as comparison to control remains.

- [A]. There should be leeway here because it has little bearing on equivalent land capability if the admixing is at low levels.

- Good/Satisfactory/Acceptable: Government (3 responses), Industry (6 responses), Stakeholder (1 response), Consultant (2 responses).

CRITERIA PACKAGE - LEVEL I
TOPSOIL/SURFACE SOIL - SALINITY

Government Responses:

- Suggest that plant species/vigour be used as an indicator for Level I. If a salt problem is suspected do EC readings as part of Level II.

- Or measurable salts (field conductivity measurements).

- This is a guess and therefore not very reliable.

- In saline areas, the applicant may want to provide an analysis because vegetation establishment may be poor or marginal.

- Can only be accurately assessed using analysis.

- The methods used here and information requirements are satisfactory based on the equipment available to us.

- Comparability. If in doubt, use salinity meter.

- No concern for most sites. Soils with problem subsoils should be tested for salinity and SAR if any subsoil mixing has occurred.

- Difficult to assess.

- Visible salts not clearly understood. During wet ground conditions, visible salts are not always visible even when on the surface.

- Analysis.

- Salinity is best dealt with in Level I under the vegetation criteria - species composition.

Industry Responses:

- Need only verify if changed from the original state.

- No problem understanding - No visible salts as proposed in criteria.

- Increased salt in topsoil or subsoil results in restricted plant growth and if present must be treated prior to application for an RC.

- Good/Satisfactory/Acceptable: Government (8 responses), Industry (6 responses), Stakeholders (1 response), Consultants (3 responses).

CRITERIA PACKAGE - LEVEL I
TOPSOIL/SURFACE SOIL - COARSE FRAGMENTS

Government Responses:

- Should be same criteria for private land, cultivated public land, and improved public and grazing areas.

- Field staff though that 10% was too difficult to "eyeball", 20% is more realistic. Should state sizes for public land.

- Graph it.

- Why are we allowing any increase and why not decrease. Rocks should be picked to the same size and density as the adjacent undisturbed land.

- Satisfactory but is tough to determine.

- Any rocks within the soil profile become difficult to estimate % with any degree of accuracy.

- The methods used here and information requirements are satisfactory based on the equipment available to us.

- Methodology for evaluating is required.

- Agree. Problem will become evident when normal farming resumes. Will be difficult to achieve in areas with thin topsoil overlying gravel.

- Should be called rocks.

- Remove variance with Public Land.

- Have to be standardized among all areas. Private Lands vs Public Lands.

- No concerns with current criteria, except that different requirements should be related to land use rather than private/public land separation.

- The changes proposed for "Landscape" should also apply here (percentage volume increase).

Industry Responses:

- Take this out and use the one for Landscape only.

- Should be compared to adjacent off-site land. No relevance to size and amount on site.

- Same as for coarse fragments - landscape. Drop as impractical and unnecessary.

- Private land or cultivated public land. If less than or equal to 10cm should be 20% by volume. Non-cultivated public land should not be an issue.

- Difficulty in determining 10% of given size of stones over lease. Should generalize category, e.g. stoniness: yes/no.

- Common sense should apply here. 0 increase is difficult to prove in natural landscape. Should be 10% increase allowed.

- Same as for "Coarse Fragments - Landscape".

- Private land or public land cultivated - if less than or equal to 10cm should be 20% by volume. Public land non-cultivated - should not be an issue.

- What is the basis of using 10% as a measurement of increase by volume and where did it originate from? The Land Capability Classification system classes anything under 8cm as not being a problem to the landscape. What will be the method used to measure 10%. An evaluation of surface area or percent cover would be more suitable.

- Subject to interpretation of inspector.

Stakeholder Responses:

- Coarse fragments allowed should be the same for public and private land.

Consultant Responses:

- Coarse fragments are a subjective criteria to evaluate.

- Approach is practical as long as enforcement is reasonable. Get rid of % more than OK 10cm. Need only state coarse fragments to be equivalent to the control. Operators do not haul in stone and rock. What is there has always been there. Pick newly disturbed stone on surface and from plow area/depth in excess of control.

- Good/Satisfactory/Acceptable: Industry (3 responses), Government (6 responses), Consultants (1 response).

CRITERIA PACKAGE - LEVEL I
TOPSOIL/SURFACE SOIL - COMPACTNESS

- Very subjective categories - perhaps limit to two, based on whether compaction is limiting to plant growth or not. Also, how can you get a proper compaction rating on a control that has to be mixed to compare with a sample point on the wellsite. Moisture content of soil greatly affects this measurement.

- Use crop condition, rooting pattern and distribution, water infiltration characteristics, machinery rutting and soil layering to identify degree and extent of compactness.

- Criteria does not really describe what it acceptable and what is not. Rooting restrictions can provide some indication.

- At what increase in bulk density will it affect growth.

- The methods used here and information requirements are satisfactory based on the equipment available to us.

- Satisfactory but may also want to note vegetation as a measure.

- Better evaluation system and rating system required.

- Have concerns with the methodology and class definitions. Should be more specific for each of the classes. Could be based on a percent of control.

- Eliminate shovel and screwdriver - should have a measurable value to eliminate subjective measurements.

- Incorporate all parameters, in ;this section, that are associated with soil compaction (i.e. rooting characteristics, layering, etc.).

- Staff have had some problems with measuring compaction in southern Alberta when soil moisture is low. The present compaction categories are very subjective. We suggest using two categories: limiting vs not limiting to plant growth.

- Experience indicates that it is difficult to accurately measure soil compaction without elaborate equipment, and the results from the measurements depend a great deal on how dry the soil happened to be at the time of measurement. We propose that soil compaction be given a secondary priority if the vegetation is growing with little or no signs of stress; compaction measurements should be required only in a Level II assessment. (We recommend that, for the Green Area, the disturbed sites be ripped at time of seed-bed preparation to help avert future soil compaction problems).

Industry Responses:

- Must be compared to off-site conditions.

- This is a very difficult parameter to measure accurately and obtain reproducible results. In addition, there is no real need to establish "compactness" guidelines if the vegetation productivity is acceptable. I suggest this parameter be eliminated altogether.

- Should not be an issue in topsoil as the landowner will be farming the site if on cultivated land. If the land is non-cultivated, as long as there is a vegetative cover, it should be acceptable.

- Varies with moisture, method of testing.

- Should not be an issue in topsoil as the farmer will be farming the site if in cultivated land. If the land is non-cultivated as long as the site has a vegetative cover, it should be acceptable.

- You should improve the soil quality based on the following ratings, rather than improve the ratings (grammar). Compaction is a very subjective evaluation and can depend greatly on moisture conditions at the time of evaluation. How will compaction be evaluated and to what depth? The use of a penetrometer would seem to be the least subjective of the methods mentioned to test compaction. Using a screwdriver or shovel to assess compaction is not particularly accurate for an official record.

- Subject to interpretation of inspector. Full off-site investigation not always completed before failing site based on compactness rating.

Consultant Responses:

- Should made note of moisture conditions at time of assessment.

- Present method of definition OK. Field test is practical. Poke down with a rod and compare to control.

- "a screwdriver" - surely you jest here! How can this be reproduceable.

- Good/Satisfactory/Acceptable: Government (9 responses), Industry (5 responses), Stakeholders (1 response).

CRITERIA PACKAGE - LEVEL I
SUBSOIL SAMPLING SCHEME

Government Responses:

- Subsoil quality can affect plant growth just as much as topsoil especially for deep-rooted forages. Suggest that the number of subsoil samples equal the number of topsoil samples.

- Subsoil should be evaluated on all sites as follows: - into native (non replaced) subsoil or minimum of 30 cm below topsoil; - at least 50cm or to native subsoil below topsoil but preferably to 1m below the surface in replaced subsoil materials in the sump, well center, flare pit, access entry areas.

- This is a bit of overkill. Most of the problems are with subsoil compaction which can be easily identified with off lease.

- We have to accept some degree of change since the subsoil and often B horizon is intermixed. Compaction, admixing and quality should be assessed.

- Add statement re more sites where cut and fill exceeds 1 metre.

- The 5 sites on roadways may be excessive. 2 may be more realistic. Difficulty of determining where facilities are on site make choosing sample locations a guess.

- Not realistic at all, I can't see how five 70cm holes are going to tell you statistically speaking if there is a problem or not.

- Subsoils (upper) should be evaluated at each sample location. The lower subsoil should be limited to the five sites as specified in the criteria.

- The wording is a little confusing. If you are asking for subsoil evaluation at the 4 control sites, plus 5 sites on lease, then I agree.

- One subsoil sample over areas such as the sump and tank area may not be sufficient enough to given accurate assessment of these areas, especially for cases where tank spillage may have occurred in one area or an invert mud system was utilized in a sump and not properly disposed of.

- Should be evaluated at each sample area. Agree with 5 locations to depth of 70cm should include quality assessment.

- Subsoil quality can affect plant growth just as much as topsoil, especially for deeper rooted plants. We suggest that the number of subsoil samples equal the number of topsoil samples.

- Good/Satisfactory/Acceptable: Government (6 responses), Industry (3 responses), Stakeholders (1 response), Consultants (3 responses).

CRITERIA PACKAGE - LEVEL I
SUBSOIL - SALINITY

Government Response:

- Suggest that plant species/vigour be used as an indicator for Level I. If a salt problem is suspected, do EC readings as part of Level II. This is a very prevalent problem in southern Alberta.

- No increase in salinity conductivity measurements (e.g. EM-38).

- A guess.

- Per previous comment for topsoil.

- Analysis only.

- Unsure how we are to assess this and how do we compare it with off-site. Visually does not seem very accurate.

- Difficult to assess unless visible salts.
- Difficult.
- Comparable to offsite.
- Analysis.
- For Level I, salinity is best covered by mentioning under vegetation.

Industry Responses:

- Salinity, whether topsoil or subsoil, should be based on its impact or direct toxicity to vegetation. Several sources of data are already available on the toxicity relationships to specific plant species. This information should be used to establish acceptable criteria, as it is based on "real" data.
- No increase in visible salts. Appears rigid.
- May result in low productivity of site if not addressed during reclamation.

Consultant Responses:

- Only through Level II will this be plausible.
- Good/Satisfactory/Acceptable: Government (5 responses), Industry (9 responses), Stakeholders (1 response), Consultants (2 responses).

CRITERIA PACKAGE - LEVEL I
SUBSOIL - COARSE FRAGMENTS

- Field staff thought that 10% was too difficult to "eyeball". 20% is more realistic. Should state sizes for public land.
- Not practical.
- May not always be noticeable or practical to evaluate. This could be hit or miss.
- Maximum size required. Also note tough to measure.
- Again, hard to determine % when rocks within soil profile. Merely a guess.
- Coarse fragments for subsoil is impossible to estimate without digging large pits, which would be impractical.
- Unlikely the five holes will be able to tell you much.
- This one may be tricky, it's a bit tough if you look at it as it's written. Consider wording to the effect that it should be comparable to offsite subsoil.
- Methodology is required for evaluation.
- Subsoil rocks difficult to assess with only one sample or two. More sampling required.
- This is a subjective judgment as it is not easily measured. I have a great deal of difficulty with this.
- Comparable to offsite.
- No distinction is necessary between public and private land, however, intended land use may affect acceptable sizes.
- Suggestions indicated for topsoil quality will also apply here.
- Again, this can be a subjective criteria to evaluate.

Industry Responses:

- Near impossible to measure. Delete.
- How to you tell how much % of coarse fragments are in a control.

- Removal of coarse fragments and decompaction of older sites with established vegetation may damage vegetation cover and be difficult to re-establish.

- Unless material imported, this should have no relevance.

- Very difficult to measure and obtain representative sample of entire lease area - delete.

- Very subjective and hard to measure. Suggest the following: private land and cultivated public land - dispose of everything hauled in, in the top 30cm; non-cultivated public land - should not be an issue.

- Cannot be assessed by volume. Private land and public land cultivated - dispose of everything hauled in, on the top 30 cm. Public land non-cultivated - should not be an issue.

- Subject to interpretation of inspector.

Consultant Responses:

- Same as topsoil but more applicable, assuming hauled in fill is more stoney than onsite subsoil.

- How can you possibly assess this?

- Good/Satisfactory/Acceptable: Government (3 responses), Industry (7 responses), Stakeholders (1 response).

CRITERIA PACKAGE - LEVEL I
SUBSOIL - COMPACTNESS

Government Responses:

- This may be very difficult to measure in dry years, especially in southern Alberta. Suggest that plant indicators, e.g. roots be used instead of screwdriver test. Many uncultivated sites would fail on this criterion alone.

- Use indicators such as crop condition, rooting pattern and distribution, water infiltration characteristics, machinery rusting, and soil layering to identify the degree and extent of compactness.

- This is one that can be measured in the field, the rest you may as well forget.

- Compare for subsoil offsite.

- Satisfactory, may want to address contact zone.

- Rooting restriction, physical layered structure, i.e. visible methods of determining compaction.

- Based on % of control which will make all measuring tools relative.

- Better evaluation and rating system required.

- Eliminate shovel and screwdriver - should have a measurable value to eliminate subjective measurements.

- Incorporate all parameters, in this section, that are associated with soil compaction (i.e. rooting characteristics, layering, etc.).

- Many old sites would fail on this criterion alone, as it is written. Compaction on old sites is most often found in subsoil. We suggest that plant indicators, e.g. roots be used to determine whether compaction is a problem.

- Suggestions for Topsoil Quality will also apply here.

- Incorporate all parameters, in this section, that are associated with soil compaction (i.e. rooting characteristics, layering, etc.).

- Many old sites would fail on this criterion alone, as it is written. Compaction on old sites is most often found in subsoil. We suggest that plant indicators, e.g. roots be used to determine whether compaction is a problem.

- Suggestions for Topsoil Quality will also apply here.

Industry Responses:

- Allow for comparisons with vegetation study. If roots are penetrating the compacted layer, should it fail? Standardize probe tool.

- Decompaction of older sites may damage vegetation cover and be difficult to re-establish.

- Should be done on every sample point with the topsoil/surface soil check.

- To what depth will subsoil compaction be evaluated?

- Grant an exception if roots penetrate the compacted layer. Standardize probe tool.

- If you have vegetative cover and the roots are penetrating any compacted zones, it should not be an issue. If there is no vegetative cover then testing should be done with a penetrometer. Use actual measurements rather than classes.

- Subsoil compactness beyond 40cm not needed.

- Grant an exemption if roots penetrate the compacted layer. Standardize probe tool.

- If you have a crop growth and the roots are penetrating any compacted zone, it should not be an issue. If there is no crop growth then testing should be done with a penetrometer.

- Subject to interpretation of inspector. Subsoiling site after reclamation usually results in some percentage of ad-mixing.

Stakeholder Responses:

- Requires a more/better defined test; the criteria/test proposed is too loosely based on the person using the shovel.

Consultant Responses:

- Acceptable, but again, soil moisture conditions should be noted at time of evaluation.

- Test with rod same as topsoil. Compare to control by feel.

- Same as surface. Much depends on soil moisture, etc. You're going to reject a site based on screwdriver failure?

- Good/Satisfactory/Acceptable: Government (8 responses), Industry (1 response), Stakeholders (1 response).

CRITERIA PACKAGE - LEVEL I
VEGETATION MUST BE PRESENT AT ASSESSMENT TIME

Government Responses:

- There are some sites (e.g. badlands) that staff may prefer to recommend no seeding. There should be an option to allow certification on the basis of Level II criteria in exceptional cases for uncultivated lands.

- Yes, or several years vegetation/crop history.

- This is a good tool and provides a gauge to compare to the undisturbed land.

- At least one growing season gives something to key in to.

- Vegetation will be required for sites on a second inquiry or for long term producers or injection wells.

■ The initial statement and in particular the vegetation performance information from previous years should be highlighted. It is very common that applications are submitted immediately after work completed with no crop performance information.

■ Not necessary on older wellsites which have been farmed over for several years prior to us receiving an application. Information can be gathered from landowner. Not necessary on D & A wellsite in all instances.

■ Agreed, but good growth does not necessarily indicate a good site and bad growth does not necessarily indicate a bad site, we need history and common sense.

■ Some form should be present, emerging crop on D & A should be acceptable.

■ Non-produced D & A wells could be assessed without vegetation cultivated land provided all six criteria are met.

■ No.

■ Essential in determination of Reclamation success. This section needs to incorporate the differences in vegetation adaptability to different soil types (i.e. forages more adapt to growing on clay soils than cereal crops).

■ If landowner states crop has been produced and yields appeared comparable to off lease, I feel assessment can be made in the fallow year.

■ Shouldn't be necessary on cultivated land for D & A's. Vegetation is important for Production Sites and grasslands. Assessing crop may mean two inspections.

■ "evidence" of . . . On crop land inspected in fall, it may be only stubble. Some inspectors won't look at when the crop is standing, puts a very narrow window for assessment. If out of rotation it may be in summer-fallow when inspected. Native grassland must be self-sustaining over at least one winter and one summer.

■ We usually require vegetation to be present at assessment time. However, there are exceptional circumstances where seeding should not be required. In these situations, Level II soils information should be required for certification with increased soil sampling density (minimum 25).

■ A certified site should not require "additional or special management in comparison to adjacent or representative lands".

Industry Responses:

■ If all Level I criteria are met, is vegetation a requirement on cultivated land? Non-cultivated - pasture - requires more input.

■ Assessment should be done before vegetation, if possible. No new sites should be revegetated before assessment.

■ This must be related to loss of production, not total site rental.

■ Timing of inspections may cause problems in cultivated areas, i.e. if landowner tills site which had good crop growth immediately prior to an inspection. Should consider allowing use of photographs to document crop growth prior to inspection.

■ Cultivated land - vegetation should not be required if Level I criteria is met. Non-cultivated - pasture - needs rework. Should be practical and site specific to the area and wishes of the landowner.

■ Private land or cultivated public land must be assessed with either vegetation, soil physical and chemistry Level II assessment, or vegetation performance from previous years. Reclamation officers must not have an option on method of vegetation performance.

■ Assessments could be done on all criteria except vegetation to facilitate more rapid certification. Photographs of vegetation could be used along with landowners opinion.

- Not necessary on Level I, D & A cultivation applications. Soil sampling should be allowed in addition to physical inspection for inquiry.

- Cultivated land - vegetation should not be required if Level I criteria is met. Non-cultivated - pasture - needs rework.

- Private land or public land cultivated - must be assessed with either vegetation, soil physical and chemistry Level II assessment, or vegetation performance information from previous years. Reclamation council members must not have an option on method. Public land non-cultivated - vegetative inspection at 12 months from seeding not at discretion.

- All the categories for vegetation assessment are very broad and undefined. :What documentation is being relied on to develop these criteria?

- May have to wait 2 or more years depending on crop rotation on private land. RO will not inspect until after at least 1 growing season regardless of conditions and quality of growth.

- It is more reasonable to allow vegetation assessment up until freeze-up or snow cover as appropriate.

Stakeholders Responses:

- Yes, and requires timelines on how long vegetation must be present.

Consultants Responses:

- Does this mean certificates will only be issued during the late spring and summer on crop land? No certificates on summer-fallow, at seeding time or after harvest?

- Real problem with this. Assume an ideal situation (June-July-August) which covers only 25% of the year.

- Good/Satisfactory/Acceptable: Government (3 responses), Industry (1 response), Stakeholders (1 response), Consultants (1 response).

CRITERIA PACKAGE - LEVEL 1
LENGTH OF TIME VEGETATION MUST HAVE BEEN PRESENT AT TIME OF INQUIRY

Government Responses:

- Should be some time frame identified. Might be problems with inconsistencies between reclamation officers.

- A site being revegetated to forages should have sustainable growth before certification. Forages generally take a full growing season to establish, but a lot depends on rainfall. If the site is being grazed, we recommend fencing to keep cattle out during the establishment phase. Fencing should be removed one year before certification to ensure the vegetation can withstand grazing pressure. Length of time variable dependent on site/climatic conditions.

- At least one crop to maturity or one complete season of pasture/grass/hay.

- Site specific. Is it a new site or an older producing site. Spring inspection based on vegetation may be premature.

- At least one winter required for grassland areas.

- Two years would be preferable.

- Two years native grassland/improved pasture.

- Here we must be able to apply common sense based on history, weather, farming methods, amendments, fertilization, land use, time of year, crop rotation, week, competition and experience.

- Grassland - signs of maturity.

- Depends or will vary between cereal vs forage (hay) vs native.

- One growing season/mature vegetation.

- Variable.

- Must have over-wintered.

- To adequately assess vegetation growth, you usually require at least one growing season and, if a possible problem is suspected, maybe longer (i.e. reclamation inspector suspects a compaction problem but first year vegetation inconclusive due to weather conditions and, therefore, requests an additional year as a waiting period). In my opinion, it takes usually a minimum of 5 years to adequately reclaim a location (that produced) with a high probability that no Environmental damage exists.

- Till self-sustaining.

- Self-sustaining. x # of years since last fertilized.

- Length of time before certification will vary with site conditions, climate and species. We require that sustainable growth be present; where forages are planted, a minimum of two years are required to achieve this. Fertilizer effects must have worn off. If grazing will be the next land use, the forage has to be established enough to take the grazing pressure.

- We propose that a site should be left for at least two growing seasons without fertilization or additions of amendments, in order for the site to attain "free to grow" status before reclamation certification may be issued.

Industry Responses:

- Extremely time consuming to check with Inspector and landowner (guesstimate?).

- No problem with present criteria.

- OK, if officers inspect in the first year of application. With the assessment and five year liability, can we not certify sites in cultivation? Too much variability between officers as to yes or no. Old sites or re-inspections should require vegetation on the inquiry.

- This must be related to loss of production, not total site rental.

- One growing season.

- Need to provide some guidelines as to how long vegetation must be present before can apply for a reclamation certificate.

- Not sufficient data to comment.

- Twelve months from time of seeding - not at the discretion of the reclamation officer.

- The active growing season varies from year to year, between species, and between ecosystems. Has any thought been given as to what kind of time frame will be involved in some portions of the province for the vegetation to reach a level suitable for assessment?

- May have to wait 2 or more years depending on crop rotation on private land. RO will not inspect until after at least 1 growing season regardless of conditions and quality of growth.

Stakeholder Responses:

- Dependent upon vegetation being grown, i.e. grasses, shrubs, trees having different timelines to determine successful revegetation.

- Length of time becomes a non-issue when the plant population is the same as the surrounding native vegetation in composition and vigor (trees not included).

Consultant Responses:

- Shouldn't be a make or break criteria.

- Good/Satisfactory/Acceptable: Government (1 response), Consultants (2 responses).

CRITERIA PACKAGE - LEVEL I
VEGETATION - SPECIES COMPOSITION

Government Responses:

- Clarification that native species may be required, especially in Green Area.

- On native prairie we recommend use of native seed (from a local source). If seed is unavailable, consideration should be given to use of species that may allow natives to eventually re-establish onsite. Use of native flowers along with grasses is encouraged, as flower seed becomes available. Use of species like crested wheatgrass and timothy that are not sod-builders is strongly discouraged. Public Lands is working with Forestry to come up with recommendations. However, these will not be prescriptive as companies are ultimately responsible for the outcome of revegetation.

- No areas with incompatible composition. Composition must be uniform throughout.

- Agree. Growth should be in sequence with the landowner's rotation and species.

- Per landowner approval.

- Species selection should be better worded. The term "compatible with" is open to interpretation.

- Compatible to adjacent land.

- Here we must be able to apply common sense based on history, weather, farming methods, amendments, fertilization, land use, time of year, crop rotation, week, competition and experience.

- Similar to predisturbance.

- Old sites seeded to what are now considered to be undesirable species will not have to be revegetated to other species (unless the vegetation is causing the site to fail other criteria, e.g. erosion). We may require new sites to be revegetated with native special (local), depending on adjacent land use.

- or a) specified by landowner.

- Release from landowner re: mix.

- This is a good common sense requirement. Landowners, in most cases, want vegetation compatible with their adjacent field. Attention to species compatibility usually aids in reducing a tremendous amount of arguments by landowners and Government officials.

- Native plants will, in the near future, be the choice species for reclamation in selected regions of the Green Area. In these regions, "free to grow" status will become a very desirable requirement for certification.

Industry Responses:

- I have not had any problems to date with arguing over this parameter.

- Must be suitable to climate or as requested by Owner/Occupant.

- Not sufficient data to comment.

- Define compatible, i.e. native species. Non-cultivated public land - grass is acceptable, should not have to reforest except in special cases.

- Contact reclamation inspector and landowner re: species.

- Public land non-cultivated - grass is acceptable, this does not mean reforestation in forested land.

- What is the definition of compatible? Who will determine this and based on what sources? Will any effort be made to correlate the lists of approved species with what is available, or provide support to make more species commercially available? How are landowner/lessee requests to be handled? Are any ecological zones going to be recognized when developing a list of approved species?

- Sometimes not practical to seed same as adjacent land ;due to time of year, terrain and soil conditions.

- Compatible in whose opinion?

Stakeholder Responses:

- Depending upon the site there may be a need for original vegetation to be regrown; not just compatible with adjacent vegetation.

- Vegetation must be the same as the surrounding native grass vegetation.

Consultant Responses:

- Document seed mixes/sources if known. Visual comparison to control without naming species. Use terms as grass, wheat or crop but stay away from species identification/formal names.

- Good/Satisfactory/Acceptable: Government (7 responses), Industry (3 responses), Consultants (1 response).

CRITERIA PACKAGE - LEVEL I
VEGETATION - HEIGHT AND DENSITY

Government Responses:

- We agree with the criteria as stated. However, it may not be realistic to expect 80% density on some sites and with some species (on sites where different species are seeded onsite from offsite). The reclamation officer should be able to vary this figure (in writing). Statement should be included that vegetation may not be artificially enhanced.

- Height and density must be uniform and consistent throughout the site taking into account differential responses to approved topographic variables and moisture.

- If site is 20% weeds and very competitive, then could reject site. Weed component to be addressed.

- Does 80% constitute equivalent capability? When crops/vegetation differ there can be other influencing factors that must be considered, i.e. when the area was seeded (timing differences).

- Here we must be able to apply common sense based on history, weather, farming methods, amendments, fertilization, land use, time of year, crop rotation, week, competition and experience.

- Must be self-sustaining and compatible.

- An indication only - comparable take into account adjacent growth (judge whether its "on its way" to being comparable).

- Clarification is required. Is the more than or equal to 80% a combination of height and density. Productivity should be a parameter.

- Necessary for certain evaluations such as long term capability.

- If a wellsite location is seeded in rotation with the entire field and height and density is only 80% of adjacent vegetation, you may suspect a problem. If a wellsite location is seeded independent of the rest of the field and possibly at a different time, 80% of adjacent vegetation may be acceptable. This statement could use better clarification.

- Staff generally agree with using more than 80% of adjacent growth when vegetation is the same as that surrounding the site. A definition of density should be included in a glossary.

Industry Responses:

- Very subjective with different officers.

- One growing season.

- This must be related to production land can sustain. Crop species for area. Annual climatic conditions.

- Not sufficient data to comment.

- Height and density should not be lumped in the same category, the criteria should be one or the other. Visual assessments are subjective, there are easy, scientific, reliable methods to sample either one of these (quadrat or distance techniques).

- May have to wait 2 or more years depending on crop rotation on private land. RO will not inspect until after at least 1 growing season regardless of conditions and quality of growth.

Stakeholder Responses:

- Too subjective - requires a definite criteria/test/standard.

Consultant Responses:

- Visual comparison to control. No significant bare patches as compared to control. Keep simple for field supervisors and contractors to assess.

- Good/Satisfactory/Acceptable: Government (9 responses), Industry (4 responses), Stakeholders (1 response), Consultants (1 response).

CRITERIA PACKAGE - LEVEL I
VEGETATION - COVER

Government Responses:

- The 40% minimum for erosion control too low. Suggest 80%. Litter should not be included. Could be other factors preventing vegetative growth.

- The 80% cover may not be achievable on some sites within a reasonable timeframe (3-4 yrs). If this is the case, the reclamation officer should be able to certify sites based on Level II soils data. The site will not be certified if erosion is still a concern. Litter can be more than 10% ground cover (just state litter will be counted as cover to a max. of 40%).

- Why is litter included in cover assessment?

- Weed factor to be noted. To be based upon weeds as competitive vegetation not per Weed Act.

- What constitutes litter? Suspect only litter from plants sown and not other forms, i.e. stubble. Vigour - acceptable.

- Even distribution across area.

- Here we must be able to apply common sense based on history, weather, farming methods, amendments, fertilization, land use, time of year, crop rotation, week, competition and experience.

- Enough to stabilize soil from erosion potential - also taking into account livestock use.

- If Reclamation Inspectors start accepting vegetation growth (on first time inspection) at anything less than about 80% cover, they could be making a premature decision on site conditions (i.e. plants require a sufficient amount of time to properly root and, therefore, indicate possible compaction or chemical problems that may exist in lower soil horizons.

- This category should be renamed as ground cover, to be consistent with Pipeline Workshop (1992). It should be defined as live plants and their litter, but excluding mulch/straw added to the site to aid plant establishment. We think that ground cover should be more than 80% of offsite ground cover whether or not species are the same, e.g. if offsite has 40% cover, then one would expect 32% onsite. Litter, in amounts comparable to those found on the control, can form part of ground cover.

Industry Responses:

- Compare to adjacent productive plants, not to total production.
- Small areas of poorer cover should be tolerated.
- Not sufficient data to comment.
- Whether adjacent vegetation is similar or not, greater than or equal to 80% of adjacent ground cover should be satisfactory. If adjacent land has less than or equal to 40% then the site must be equal to adjacent land. On muskeg locations where the pads are being left and there is no erosion potential, 50% cover would be acceptable as long as the site was originally seeded to a forestry mix. Note: Pads should be allowed to be left on muskegs and sloughs (with no purpose) as long as the land classification is maintained or improved and must have landowner consent.
- Public land non-cultivated - on muskeg locations where pads are being left, there is no erosion potential, and the site cannot be seen from the road, percent coverage would still be acceptable as long as the site was originally seeded to the forestry mix. Whether adjacent vegetation is similar or not (greater than or equal to 80%) of adjacent ground cover should be satisfactory. If adjacent land has less than or equal to 40%, then the site must be equal to adjacent land.
- Again, visual measurements are subjective, cover can be measured easily and reliably with established methods (Daubenmire cover classes). Litter may make up to 10% of the ground cover. Why can't litter be equal to or greater than adjacent lands? How will this be compared to adjacent areas? Having only 10% litter could be considered a good indication of heavy grazing and poor range condition or intensive tillage practices. Special practices such as straw crimping are not effective at 10% ground cover. What consideration will be given to drought conditions, where litter would be a definite advantage?
- Subject to interpretation of inspector. Full off-site investigation not always completed before failing site.
- Density of annual crop may be a reflection of seeding rate; total cover is affected by cultural practices (grazing, etc.). Use of crown densities possibly.

Consultant Responses:

- Visual comparison to control. No significant bare patches as compared to control. Keep simple for field supervisors and contractors to assess.
- Good/Satisfactory/Acceptable: Government (10 responses), Industry (5 responses), Stakeholders (2 response), Consultants (1 response).

CRITERIA PACKAGE - LEVEL I
VEGETATION - ROOTING

Government Responses:

- This should be used to help determine whether there is a physical (compaction) or chemical problem in the soil. OK to have restrictions if adjacent land has them.
- add " . . . in relation to control conditions".
- This goes hand in hand with compaction.
- Acceptable - this is or can be directly related to the compaction criteria.
- Reference to compaction and layering.
- Here we must be able to apply common sense based on history, weather, farming methods, amendments, fertilization, land use, time of year, crop rotation, week, competition and experience.

- Healthy - vertical.

- Definition and classes required.

- Satisfactory. Incorporate with the compactness section as an indicator of compaction.

- Free to grow.

- Vertical, free to grow. Check compaction.

- This is a good indicator of physical or chemical problems in the soil. The explanation could be expanded to include discussion of compaction, etc. We should add "when compared to controls". It is okay to have restrictions if adjacent land has them.

Industry Responses:

- Relates to compactability of soils.

- This is covered under the compaction issue.

- No obvious rooting restrictions.

- Land capability. Time to regenerate as surrounding.

- Not sufficient data to comment.

- Covered under compaction.

- How are rooting restrictions assessed? This is more logically addressed under compaction of soils, since compaction should be alleviated prior to topsoil replacement and seeding.

- Subject to interpretation of inspector.

- Need confirmation checklist on form (control).

Consultant Responses:

- Measure with soil sampler and compare to control. None or minimum root restrictions.

- Good/Satisfactory/Acceptable: Government (7 responses), Industry (4 responses), Stakeholders (2 responses), Consultants (1 response).

CRITERIA PACKAGE - LEVEL 1
VEGETATION - BARE AREAS

- An addition to this criteria should be any variance from the norm will not be certified unless erosion is not a concern and Level II soils data confirms that chemical/physical properties in the soil are not the cause.

- Should not be located in erodable locations.

- Acceptable - care is necessary to be aware of possible sterilants or gas migration problems. These usually have distinctive patterns.

- An addition to this criteria should be any variance from the norm will not be certified unless erosion is not a concern and Level II soils data confirms that chemical/physical properties in the soil are not the cause.

- Should not be located in erodable locations.

- Here we must be able to apply common sense based on history, weather, farming methods, amendments, fertilization, land use, time of year, crop rotation, week, competition and experience.

- Depending on species, soils, location.

- Size determines judgment.

- Size should determine concern.

- We suggest an addition, "Sites with significant variance from the control will not be certified unless erosion is not a concern, and Level II soils data confirms that chemical/physical properties of the soil are not the cause of bareness".

Industry Responses:

- Needs tighter refinement to establish how big or small a bare area can be before it creates a problem.

- Small, bare areas will fill in with time. Account for season.

- Within reason.

- Not sufficient data to comment.

- OK with exception of pads.

- Some degree of latitude must be allowed by Reclamation officers. We have had leases that had standing crops that were chest high rejected for certification because a small patch (perhaps the size of a desk) was not growing anything.

- What compensation will be made in the drier areas of the province where cover of Little club-moss (Selaginella) is nearly 100%? Club-moss does not regenerate once disturbed by procedures such as topsoil stripping. Selaginella is considered an indicator of over-grazing and abuse of prairie pastures, and has no forage value for wildlife or domestic use.

- Subject to interpretation of inspector.

Consultant Responses:

- Same as control or evidence present that bare areas will be invaded.

- Good/Satisfactory/Acceptable: Government (11 responses), Industry (3 responses), Stakeholders (2 responses), Consultants (1 response).

CRITERIA PACKAGE - LEVEL II
LANDSCAPE

[A]. SLOPES
[B]. EROSION

Government Responses:

- [A]. Gradients must not exceed original slope gradients. [B]. Erosion initiated on site must not be allowed to migrate, reinitiate erosion offsite. Must be contained.

- [A]. In cases of farmland, should ensure does not exceed safety slope angle per equipment. [B]. Satisfactory.

- [A]. Does the slope gradient differ from Level I, contours must conform to original. [B]. Accept.

- [A]. Satisfactory. [B]. This statement is poor considering a landowner adjacent to a wellsite location could be utilizing farming techniques that are accelerating the erosion process. An oil company does not have the right to accelerate the erosion process just because the landowner is using poor farming techniques.

Industry Responses:

- [A]. Slight concern that this might be too stringent on a few old sites. [B]. This could potentially cause a failure on native prairie where crested wheatgrass was planted. Could be used by lessees to force reseeding.

- These should be the same as Level I.

- [A]. These must be addressed at the time of reclamation. [B]. Is this not covered in Level I or should it not be.

- [A]. Same as Level I - reasonably comparable to original. [B]. Agreed.

- Covered under Level I.

- Not required.

■ [A].Slopes are workable, however, landowner "land use" should be considered. [B]. Accept.

■ Covered under Level I.

■ There is no allowable variance or ability for grandfathering of sites previously constructed. If the gradient is less than the original, will this conflict with the criteria to return the landscape to pre-development contours? How was a 10% topsoil loss from erosion determined to be critical? Also, this implies that a 10% loss from erosion and a 10% loss during topsoil replacement for a total of a 20% topsoil loss is acceptable?

Stakeholder Responses:

■ [A]. OK. [B]. Should there be a minimum rate set in case the off-site rate exceeds what's reasonable?

Consultant Responses:

■ [A]. Slope conditions should be allowed if the landowner is willing to have them. Otherwise ±20% original. [B]. Needs some adjustment for slope that was accepted.

■ Good/Satisfactory/Acceptable: Government (11 responses), Industry (2 responses), Stakeholders (1 response), Consultants (1 response).

CRITERIA PACKAGE - LEVEL II
SOIL

[A]. ORGANIC MATTER
[B]. CHEMISTRY

Government Responses:

■[A]. "evaluated to a minimum depth of 100cm from surface on to native (non-replaced) subsoil. [B]. OM content - measured as stable (non-amended) material.

■ [A]. Why only 80%. [B]. Agree.

■ OK. This section should include compaction investigation.

■ This area is subject to the resolution of the Leskiw effort.

■ [A]. Will 80% OM content provide equivalent capability. [B]. Acceptable.

■ Soil analysis must be detailed enough to identify the problem and provide remediation solutions to the soil problems which exist.

■ I'll leave this up to Arnold, it seems fine to me, except for the texture references being different than the triangle provided.

■ Add compactness level, infiltration, bulk density, etc.

■ [A]. Should be consistent with Level I. [B]. Satisfactory.

■ Compaction requires to be quantified under Level II analysis. Would aid in settling disputes. Under Texture and Structure section of Level II: Topsoil/Surface Soil. Texture: In the Good, Fair and Poor categories, Silt (SI) and Sandy Clay (SC) have not been categorized and should be included.

■ Analysis to determine remedial work.

■ [A]. The 80% of control will be too stringent for old sites. We suggest that this category be broken down to: new construction, 1982-1993, pre-1983, as well as by land use. [B]. May be too stringent for older sites where admixing brought more saline/sodic/acidic subsoil materials into the upper soil horizons. Suggest that this category be adjusted for date of construction and land use.

Industry Responses:

- [A]. Should be only 70%. [B]. OK

- Merely adding confusion to system.

- [B]. The "no negative change in rating" is impractical for many sites. A negative change in rating should be allowed as long as the site meets the requirement of equivalent land capability. Equivalent land capability does not require identical soil chemistry.

- [A]. Should be no different than Level I criteria for soil and organic matter. [B]. pH - change of rating of one class. In forested areas with a pH of less than or equal to 6.5 then a max. value change of 1.5. Salinity (EC) - when EC is less than or equal to 4 the site is satisfactory. When EC is greater than 4 then max. change from control EC is 1. Sodicity (SAR) - when SAR is less than or equal to 8 the site is satisfactory. When SAR is greater than 8 then a max. change from control SAR is 1.

- Not required.

- [B]. What is the origin and scientific basis of the criteria for pH, EC, SAR, etc. and applying them to the White and Green Areas of the province? Using the same basis of evaluation for agricultural soils in the Eastern Slopes as those in the Brown Soil Zone is not appropriate. Why are we still having to use these absolute criteria numbers?

Consultant Responses:

- [A]. Bit difficult to measure and achieve after. [B]. As long as range within rating is allowed. However, if initial EC (3.5) and the end result is poor (4.2), it should still be OK as the EC change was still less than 1 but it did cross a rating boundary. Drill waste disposal can change EC from 1 to 4, after 4 can change it by 1 unit.

- Good/Satisfactory/Acceptable: Government (8 responses), Industry (2 responses), Stakeholders (2 responses), Consultants (1 response).

CRITERIA PACKAGE - LEVEL II
VEGETATION

Government Responses:

- Guidance on how to conduct Level II vegetation assessment may be in order - suggest an information letter be developed.

- What specific methods?

- Should be texture. Having two texture classifications creates a problem. We may want to develop one system.

- Statement re: methods for assessment will be provided by Council - I'm not sure what we would or could provide.

- Must have even growth comparable to offsite and be compatible.

- I would like a copy of the methods for the quantitative assessment of vegetation.

- LCRC inspectors do not have involvement on initial construction phases like Crown Land Inspectors do, so they have to rely on indicator parameters to a great extent in determination of reclamation success. Vegetation is essential in this process.

- Should be explained that Level II vegetation assessment (quantitative vs qualitative assessment) will be required when there is disagreement between parties at the inquiry. Failure of Level I vegetation criteria (e.g. vigour, height, density, cover, rooting and bare areas) could trigger a Level II soils assessment. The links between soils and vegetation should be better expressed.

Industry Responses:

- Not necessary on first time inquiries in cultivation on private land.
- Establishment essential.
- Eliminate - Assess by Level I vegetative assessment or Level II soils and chemical data.
- Assess by Level I vegetative assessment or Level II soil physical and chemical data.

Consultant Responses:

- Define these methods.
- Method of assessment should be agreed to with operator and LCRC having 50-50 weight. If landowner a 3rd party, then his vote puts everyone at 1/3.
- Good/Satisfactory/Acceptable: Government (11 responses), Industry (3 responses), Stakeholders (1 response).

RECLAMATION CERTIFICATE APPLICATION FORM
GENERAL COMMENTS

Government Responses:

- Not suited to access roads.
- On the new certificate applications, very few companies are able to provide full information about their wellsites. Generally, we will welcome the additional information.
- This is a big improvement from the old schedule #1.
- Long overdue, have had no criticism only praise from the private sectors.
- If a new information letter is going out, indicate do not leave any areas blank if information is not available - indicate information not available. Advise company if there are any circumstances concerning the application they can send in a covering letter explaining any problems or situations not covered in the application form.
- The concept of the form is a good one. We may want two names on application, one to cover administrative data and a second to cover field assessment.
- Companies should be given the opportunity to justify a site that may fail to meet some of the criteria parameters.
- Could use a comments section to explain unusual circumstances and clarification of information.
- Information is essential in protection against possible persecution in an environmentally aware society. The application form should aid in providing Industry and Government with the necessary information requirements. The Well/Battery Name is required in four different locations on the application form. Is it necessary?

Industry Responses:

- If criteria is revised, the form only needs minor changes. If no tolerance is given, the form is not workable.
- The criteria and form are too rigid. If one sample fails on admixing, you are obliged to put NO in the Meets Criteria column. There is no leeway for additional justification.
- Very few companies are able to provide full information about old wellsites. Companies are unsure about missing information and what will cause their application to be rejected. An information letter would be helpful.
- Does not allow for common sense or the small amount of cases that will require an explanation.

- LSD and date should be at top of form.

- The form is inadequate as a working document.

- Lease sample point sketch area is too small - no room for access road diagram. Blackened in areas are wasted space.

- This form is the only place that construction and operation of each site is addressed. Wellsite applicants need to be appraised of information required for this document at the time they are given construction approval.

- Benefits: Outlines and defines expectations & required objectives for reclamation requirements. Should result in less controversy between RO, land-owner and industry after all concerned parties are educated and Criteria concerns are resolved. Concerns: Problems with interpretation of soils and soil profiles by inspectors due to lack of experience or soil science education. Lack of, or inability for flexibility of inspectors ("common sense" not always present during site inspections in some areas). Lack of RO inspectors (some sites waiting 2 or more years for inspection). Change of inspectors during reclamation process. Old construction sites may not have any topsoil for redistribution as soil conservation was not an issue 30 years ago. Current proposed criteria cannot be met on sites constructed during Winter months. Cost of reclamation to meet the new criteria, on some sites, cannot be justified. Oil Industry being treated differently (more severely) than logging and farming industries. RO inspectors not available for on-site discussion. Inconsistency of RO inspectors between areas. Inspections of White Area Public Lands & Private Lands completed in 93 were passed or failed based on "New Criteria" regardless of when the reclamation had been completed. Suggestions for Improvement of System: Use certified 3rd party inspectors paid by industry or RC permit fee, Contracted as required so that RC applications are addressed within 30 days of receipt. RO inspectors to be available for onsite discussion as required prior to construction and reclamation. Separate Criteria for Public Lands in the Green areas and Private land. 1 more season to Test and fine-tune the criteria prior to finalizing the regulations. Flexibility of criteria is required (100% pass of all Criteria on older locations cannot be achieved without topsoil replacement and/or other amenities). Provisions for negotiated approval for a Reclamation Certificate on sites where excessive reclamation costs cannot be justified by the end result.

Consultant Responses:

- See individual sections.

- A standard industry set of forms should be set up with space to comment on areas when reclaimed conditions do not meet criteria. If available a presite assessment should accompany the certificate application. i.e. a second form or adjust the existing form.

- Good/Satisfactory/Acceptable: Government (8 responses), Industry (3 responses), Stakeholders (1 response).

RECLAMATION CERTIFICATE APPLICATION FORM EASE OF USE AND FORMAT

- The first reaction from field staff was that the form was too complex. However, I have received requests for other information to be added. Some categories could use more space for comments.

- Good. Some areas may require more detail. Space should be provided. That can be achieved by taking the return section and compressing it.

- Part II, No. 8, 9 and 10 require separate sheet for explanations.

- Format is fair, tends to lend itself to abuse, a company could and some will just fill it full of yes with no justification, leaving the inspector no better off than we are now. Not a stand-along document, you must have the write-up with you.

- Site data should be easy to reference and form its own page.

- Shouldn't be that difficult if proper documentation has taken place.

- The form is relatively easy to fill out and use. Format: See site date section below.

- Some categories require more space, especially the site data section.

Industry Responses:

- Not user friendly at all (criteria sections).

- Field sheets must be used to document the necessary information.

- Not adequate room for indicating sample point ID and soil depths. Would prefer letter size document for ease of use in field.

Consultant Responses:

- Too small spaces.

- Good/Satisfactory/Acceptable: Government (8 responses), Industry (4 responses), Stakeholders (1 response), Consultants (1 response).

RECLAMATION CERTIFICATE APPLICATION FORM
SURVEY PLAN

Government Responses:

- May be awkward to deal with access.

- Require elevations, drainage systems and any other features, show sump and flarepit locations.

- Not necessary.

- As much detail as possible.

- Valuable once companies supply the sketches.

Industry Responses:

- Why five copies? Older plans do not show detail as do current plans.

- Are five copies required?.

- OK as long as the details on the plan can be shown as a sketch rather than have to get surveyors back.

- Five copies of existing survey plan deemed reasonable.

Consultant Responses:

- Amend to cover 400m circle around wellsite.

- Good/Satisfactory/Acceptable: Government (13 responses), Industry (4 responses), Stakeholders (1 response), Consultants (1 response).

RECLAMATION CERTIFICATE APPLICATION FORM
GENERAL INFORMATION SECTION

Government Responses:

- No provision to check off access.

- Add. Clean up contractor (name and address). Entry or non-entry.

- Good. Current occupant and not the one when the well was drilled.

- Satisfactory. May want to include section on the municipal land use zoning.

- Note #5 - High or low profile not necessary, a grade was either built or not. #19 - Since we don't know what a suitable condition is, why ask. #5, 14, 15, 17, 18 - could be combined. Generally needs more room to answer the questions.

- Required for those uncertain areas.

- What happens if information is missing or unavailable? Should indicate clearly what is expected in situations where wellsite is on private land and borrow pit/sump/camp is on public land and vice versa. If two certificates are required, this should be stated.

Industry Responses:

- Little thought or input from industry on how labour intense this is. May require multi-departments to supply all information.

- Differentiate between D & A and Abandonment.

Consultant Responses:

- Provide space for the applicant and address and for the applicant's agent and address.

- Good/Satisfactory/Acceptable: Government (11 responses), Industry (6 responses), Stakeholders (1 response), Consultants (1 response).

RECLAMATION CERTIFICATE APPLICATION FORM
SITE HISTORY SECTION

Government Responses:

- Separate sheet required for explanation.

- Perhaps areas where improvements are left in place should be excluded from the certificate and a letter of authority issued to the occupants who want the improvement. This way reclamation responsibility is transferred.

- Should include space for identifying previous owner/operations on the site. Any environmental risk assessments or site assessments, or remediation plans implemented on site or in progress.

- Good and much needed. This is a good start point (basic) to get industry maintaining better documentation.

- Part 10 should include details of all remediation work (i.e. add topsoil, blowdirt, etc.) and the status of pipelines.

- The first 16 items are structured columnar but 17 to 19 are offset - can be confusing.

- Item 7 should be expanded to include any contaminants and full disclosure of sampling methodology and analysis.

- Note: #18 should be expanded to say no inquiry will be held if releases not submitted.

- Areas (where improvements have been left in place) should be excluded from the certificate, and on public land, a letter of authority or disposition issues to the occupant who wants the improvement. We have to ensure that the correct reclamation responsibility is transferred.

Industry Responses:

- Some data may not be available as requested. Drilling waste data is submitted once already to a mail data base and is not necessary.

- Brief history may have to be enclosed.

- Important to have information on this. Rework section on underground facilities removed.

- Some of this data will not be available for older sites - information on sterilants, sump location.

- Too restrictive. Additional sheets will have to be attached for items 7, 8, 9, 10, 11, 12, 13. #3 information is not necessary as waste disposal forms will be attached. #16 - concrete & gravel should be separate from other debris.

- Older sites often have little or no record of lease construction or restoration details. Also applies to properties acquired from another operator.

- With all the emphasis on comparison to original conditions, shouldn't there be some requirement to include that documentation? How are pre-1993 and pre-1983 sites going to be addressed, since much of this either won't have been done at all or there is no information available? #3 Should reference also be made to the sump construction date? #6 Seeding Date: Why is it necessary to attach all this information? This should have been provided in the application for development up front, and only species approved under these guidelines should be used. What is the definition of seed certificates: tagging from seed bags, weed certificates on seed allotments or mixes? The method of seed application should be included as important site information. #8 Herbicides/Sterilants: What will be acceptable if this information is not available? #15 According to the criteria, no debris should be present on the site and coarse fragments should not increase more than 10% (for fragments smaller than 10cm). #17 Add NO to checklist.

Consultant Responses:

- OK, but most dates they ask for will be unavailable. For #7, 8, 9 and 10, at least one or two lines should be available for response.

- Good/Satisfactory/Acceptable: Government (3 responses), Industry (1 response), Stakeholders (1 response), Consultants (1 response).

RECLAMATION CERTIFICATE APPLICATION FORM
SITE DATA SECTION

Consultant Responses:

- Not suited to access roads.

- Short form of criteria could be added for easy reference.

- The wellsite should be gridded and numbered so the company just has to add their numbers - i.e. 25 wellsite plots will be the same and controls may vary.

- Require both topsoil and subsoil tables. Use 3 rows for control and 5 for wellsite. Need a road plan. Need north direction arrow.

- Extremely poor. We require a standardized worksheet that will also cover as a check list, so that as the plots are done all this necessary information can be recorded (see attached example). What I vision we will be receiving is a bunch of dots in a square, with a pile of yeses down the right side.

- There is no space available for roadway assessment data.

- Good and much needed. This is a good start point (basic) to get industry maintaining better documentation.

- The sample locations with topsoil depth information should be easily readable.

- Again, as much history as possible required.

- Topsoil/surface soil depths section: This area is too condensed and should be redrafted. Meets Criteria: Yes/No sheet is confusing and cumbersome and requires additional work.

- Topsoil/surface soil depths should be shown on a larger diagram. Should also include position title of individual doing assessment. Should remove shaded areas. Should also include a space for verification by C & R inspector.

- A short form of the criteria (i.e. acceptable numbers/ranges) could be added for easy reference. No room for soil depth data from access roads. A space should be provided for vegetation species lists on and offsite.

- We proposed that the components be separated into two (land use) categories - Private Land, and Public Land (Green Area) to make it easier to complete and assess an application.

Industry Responses:

- Inadequate size for volume of data required. Revise Yes/No to Yes/No/If No - Justify.

- Need room for site specific cases that will not be answered yes, because of various circumstances.

- No need for separate charts and numbers.

- Not big enough area - separate page - may include photograph of pre-disturbance condition.

- Additional space useful for recording site data.

- Needs to be expanded.

- Why so many control spaces when only 4 requested? Note - no reference to access roadway.

- Note: #2 Soil: Topsoil depth (cm) and Surface Soil Depth (cm)? What is the distinction, since by your definition surface horizons are "topsoil"?

Consultant Responses:

- Provide an area for the access road sketch.

- This should be worked into the site sketch page.

- Good/Satisfactory/Acceptable: Government (6 responses), Industry (2 responses), Stakeholders (1 response).

RECLAMATION CERTIFICATE APPLICATION FORM
OTHER INFORMATION SECTION

Government Responses:

- Separate to reflect 1) owner, 2) occupant.

- Should ask for reasons if L.O. not involved with final inspection. If L.O. has concerns about reclamation, CO should clarify why nothing was done to alleviate LO concerns.

- Land and Forest Services see the need for these criteria for the Green Area. Some flexibility on our part in applying the full criteria could be considered in some individual situations in 1994 only. Communication between our field staff and industry will serve both well if we are to apply these criteria successfully.

Industry Responses:

- If the landowner refuses to sign off because of a perceived problem with the reclamation, but the company feels the lease passes the criteria, will a rec. certificate be issued without landowner approval? i.e. landowner irresponsibility should be addressed.
- Note: #1 Private Land/Public Land: What is the rationale for performing an inspection with the Landowner/Occupant? Is this a requirement? #3 Define inquiry. Does this refer to a joint on-site inspection or assessment with certification personnel, or is this a "legal" inquiry?
- Good/Satisfactory/Acceptable: Government (15 responses), Industry (7 responses), Stakeholders (1 response), Consultants (2 responses).

RECLAMATION CERTIFICATE APPLICATION FORM DECLARATION SECTION

Government Responses:

- Two or maybe three signatures required.
- May have to be toned down.
- Should be signed by the person that has done the assessment.
- Should be signed by whoever does the assessment. We want to be able to rate the assessor which could make auditing easier.
- This is the only place that groundwater is mentioned in the whole document. Surface water should also be included, and both should be addressed elsewhere in the document. Agencies dealing with water contamination should be mentioned in the introduction, issues such as sedimentation should be addressed in the landscape criteria.
- Included in this section should be date application sent for certificate as the date used now in some cases is not the date the application was sent in. Also name and phone number of person sending in application as name used on first page for contact is generally a field person who can't answer some of the general information which may have been missed on the application.

Industry Responses:

- Too narrow, if no soil, chemical or physical problems and no loss in crop yield, etc., but if criteria are not met, should a lot more work and expense be thrown away at the site? Should be able to apply with justification for not meeting certain aspects of the criteria.
- Unclear as to who can actually sign this area. Should be signed by on-site supervisor.
- Signed by officer or manager? Authorized personnel? (not by clerk)
- In many cases it may not be possible to certify that "there are no soil chemical or physical conditions that resulted from XYZ's use of the land that may adversely affect soil or groundwater" What are the legal implications for the licensee if problems are identified later?
- Generalize this section. Note: People completing Page 1 may not be same people completing Page 2. This makes it difficult to complete declaration.

- This declaration is not necessary if the documentation for all the assessments is supplied as requested in the criteria. The applicant for a certificate should only have to state that Reclamation Criteria have been met and no other conditions apply. Only Level I is certification criteria. If government insists on including Level II, it should be as a supplementary bulletin (report) which describes how to go about identifying, characterizing, rectifying the problems. The declaration is the first place any reference to groundwater is made. How many copies of this application are required? One each to Chairman/Deputy Chairman, or two each?

Consultant Responses:

- Provide or allow a subheading for the client's agent (on behalf of).

- Expand to allow for contractor, consultant or whomever took responsibility for the work to be identified along with the licensed operator's name/contact.

- Good/Satisfactory/Acceptable: Government (13 responses), Industry (3 responses), Stakeholders (1 response).

RECLAMATION CERTIFICATE APPLICATION FORM
SITE SKETCH

[A]. CONSTRUCTION PHASE
[B]. OPERATIONS PHASE

Government Responses:

- [A]. Very helpful if available. [B]. Should add other facilities such as flarepits, tanks, berms, etc.

- [A]. Water diversion ditches to be added. [B]. If partially reclaimed (all but donut) then topsoil storage to be clear.

- [A]. Needs a proper and consistent legend. [B]. Not necessary, the information can and should be combined, only one sketch necessary.

- [A]. Should be used to keep proper assessment of soils on site, i.e. storage and usage.

- Should include campsite location because often can be a bigger problem than the wellsite. [A]. Include symbol for garbage pit. [B]. Satisfactory.

- [A]. Low areas/undisturbed areas/general plant communities should be indicated. [B]. Location of any low areas, waterbodies, fencing, pads, etc. should be shown. Other facilities such as: flare pits, tanks and berms should be shown.

Industry Responses:

- [A]. Depending on well history, may not be available. If site assesses as a pass, is it required?

- Many original construction layouts not available.

- [A]. OK [B]. Small

Consultant Responses:

- [A]. This may not be available unless the requirement for sketch assessments is mandatory during the construction phase. [B]. Acceptable.

- Improve it with a grid to help stay to a scale. 1 or 0.5 cm grid where size of drawing may cover 140m x 140m. One could let one square equal 5m, 2m or whatever.

- Good/Satisfactory/Acceptable: Government (12 responses), Industry (6 responses), Stakeholders (1 response).

APPENDIX 'J'

WELLSITE RECLAMATION CRITERIA: LETTER/MEMO RESPONSES

WELLSITE RECLAMATION CRITERIA: LETTER/MEMO RESPONSES

SOILS CRITERIA - GENERAL COMMENTS

Government Responses:

- Where undeveloped treed land has been converted to hay or pasture (private land), consideration should be given to a fairer evaluation of the control LFH layer. Throughout clearing, construction and reclamation processes the majority of this is lost, even though it could represent up to half or more of the control topsoil depth, making it impossible to meet the criteria. For example, if you had 6cm of LFH and 10cm of Ae totaling 16cm of topsoil once mixed and allowed to decompose for a couple of years you would likely only end up with a higher organic Ae to a depth of 10-12cm.
- The term "surface soil" should be removed as it serves only to confuse the issue. Forestry field personnel and industry have been quick to point this out.
- Topsoil definition needs to be expanded to include those soils which fall into the surface soil category.
- Topsoil - % Admixing: The type of subsoil mixing should be recognized. Difficulty in estimating subsoil mixing in soils with poor color change between the A, B and C horizons.
- Topsoil - Texture: The standard texture classes as specified in the Level II criteria should be used.
- Topsoil - Layering: Definitions required for what layering is and for the classes of layering.
- Topsoil - Coarse Fragments: The standard should not change based on ownership but on land use and soil type.
- Topsoil - Compactness: Definitions required for compactness and for the different classes of compactness. Level II diagnostics are required.
- Criteria for layering and texture needs to be included in the subsoil evaluation.
- The criteria should include evaluation of the upper subsoil at each assessment point.
- Coarse fragments should be called rocks.
- The principal of layering was not well understood and the three categories are inappropriate (no difference, evident difference, obvious difference).
- Percent admixing of subsoil needs clarification.
- Topsoil/Surface Soil: There should not be a distinction between private land, cultivated public land and non-cultivated public land. Topsoil is topsoil and should be treated the same regardless whether it is private or public land.
- The texture class triangle's terminology (fine-loamy) should match the Level II assessments. Should be able to find Sil or VFSL written in the triangle not the words or vice versa. We should keep our references consistent throughout the document.

- I have a concern over the proposed "particle size triangle" proposed in the April 1993 version versus the modified "textural triangle". I would like to know why the modified textural triangle was not used? As you know, the particle size triangle differs from textural triangle in that one refers to grain size distribution of the whole soil while the other refers to the fine earth fraction only. The particle size triangle represents a compromise between engineering and pedological classifications. It is my understanding that Level II analysis is intended to be the analytical part of the criteria which is to be no more scrutinizing than Level I analysis, the Level II analysis giving the actual numerical parameters to Level I standards. As it sits now, you have the particle size triangle for Level I and the textural triangle for Level II. The textural triangle for Level II analysis represents something much more difficult and scrutinizing than the particle size triangle for Level I analysis. The two triangles do not even mesh consistently when you compare percentages of clay along the X axis of the triangle. At least the modified textural triangle would mesh with the textural triangle and would allow for more consistency between Level I and II textural analysis. In addition, there is no place in the criteria which explains the difference between triangles under Level I analysis (page 5 of criteria) versus Level II analysis (page 9 of criteria) which will create some confusion with Industry.

- An additional concern was that the criteria only requires topsoil to be stripped while giving no net worth to the B horizon material. In areas with topsoil depths of less than 15cm, the B horizon becomes increasingly more important as a medium for properly re-establishing a rooting zone. In the Peace Country, generally, as you strip to greater depths (i.e. through B horizon into C horizon material), you encounter increasing amounts of clay content. With no requirements to separately strip the B horizon in the criteria, much of the material returned during abandonment is a BC horizon mix which is higher in clay content.

- Incorporated into the criteria are many parameters (i.e. compactness, layering and rooting) which require subsoil to be properly addressed in order to be successful for Reclamation purposes. The problem created is the B horizon has not been separately stripped and the higher clay content of your BC horizon mix creates all kinds of compacting, layering and rooting problems which creates a fail under the new criteria. This creates frustration for the contractors in that they feel they have followed the criteria but are still having locations failing the criteria due to subsoil and vegetation problems. In order to alleviate this problem, it is recommended that the criteria include two toning locations as a requirement and/or give value to the B horizon as an important rooting medium on lands with shallow topsoils and subsoils high in clay content.

- During the overview analysis, of each of the sites by each of the groups, not one group described soil texture based on the soil textural triangle presented under Level I analysis. Texture was described according to the "real" textural triangle as given in the Canadian System of Soil Classification. Many individuals recommended it to be changed.

- Soil Quantity: On pre-1983 construction, we will only use vegetation criteria for certification. On sites constructed between 1983 and 1992, we will require a minimum of 60% of control soil depth (with an over-ride based on vegetation criteria for native prairie and sensitive areas). On new sites, 80% of control soil depth will be required (with the same over-ride for native prairie and sensitive areas). Allowable sample variability: 80% of sample sites must meet 80% of average equivalent soil depth on the control. 100% of sites must be more than 40% of average equivalent control soil depth (with over-ride, as above).

- Soil Quality: Only vegetation criteria will be used on pre-1983 sites. We require a vegetation criteria over-ride for post-1983 sites where site re-disturbance is inadvisable. Less than 20% admixing on new construction is acceptable for all land types. Less than 50% admixing is acceptable on any pre-1993 sites. Layering should be made a part of the vegetation criteria. Aggregate strength as a criterion should be limited to Level II soils criteria.

- Part 2 - Environmental Protection Guidelines: Page 4 - Section 3.2 - I suggest that soil stripping for forested areas in the Green Area should include only mineral materials and exclude the overlying surface organic (duff) material. The duff layer is readily compacted and broken down, resulting in less surface soil bulk for reclamation.

- Part 3 - Reclamation Criteria for Wellsites and Associated Facilities: Pages 2, 5, 7 - The evaluation of coarse fragments should be the same on public and private lands. Use private land criteria. I prefer that examples of coarse fragments be gravels, cobbles, and boulders. Stones and rocks are too generic and insufficiently defined.

- Page 3, Topsoil/Surface Soil - Add a short introductory paragraph to explain why we are using the terms "topsoil" and "surface soil" (e.g. to ensure sufficient material is stripped for even replacement and to ensure maintenance of soil capability) and then define the terms in the same paragraph.

- Page 3 - Reword the first sentence in the 1st paragraph to "For cultivated and non-cultivated arable lands, and native range lands, topsoil is defined as . . . "

- Page 3 - Reword the first sentence in the 4th paragraph to: "For lands with little to no topsoil as defined above (often eroded or forested), "surface soil" will be defined as . . . "

- Page 4 - e. Change headings to conform to the above rewording for page 3 that is, Cultivated and Non-cultivated Arable Lands and Native Range and Eroded or Forested Lands.

- Page 5 - Change title to: Cultivated and Non-Cultivated Arable Lands and Native Range.

- Page 5 - Private and public land requirements should be the same. Use private land criteria.

- The topsoil/surface soil distinction between private and public land should be removed since it creates a double standard.

- Topsoil Quality: Quality standards should not be based on ownership but on land use and soil type.

- The following is a general overview of some of the comments and concerns of individuals who attended the Reclamation Criteria PITS course. The definition of surface soil as opposed to topsoil was clearly identified to the students. Many individuals were confused by the difference and suggest that topsoil be the one and only term used. (Note: All the Alberta Forest officers attending agreed that topsoil be the only term used). Some suggested that if there is going to be different standards between Green Area lands then use the word topsoil to apply to both areas but put a clarifier that "topsoil quality criteria" only applies to White Area lands. Also mentioned was using cultivation as the break to denote the differences between Green Area versus White Area lands versus private lands. If different standards are going to be enforced on different jurisdictional areas, then they should be broken up based on their boundaries and not whether they are cultivated or not. The problem arises especially on lands that are within the White Area boundary, are bush lands and are potentially arable for cultivation (agriculture). This is generally not a problem in Southern Alberta but it is very applicable to most areas in the Peace River area.

- The present soils definitions are unclear. Consistent soils definitions that are agreed upon and understood by all parties are required. Public Lands has reviewed all existing soils definitions in relation to reclamation, and has developed a set of definitions that can be used as a starting point.

Industry Responses:

- The difficulty of constructing sites to conform to the new criteria during winter operations due to stripping frozen ground and preventing admixing must be addressed.

- The main problem with the new criteria that we have experienced are obtaining required topsoil depth, and prevention of admixing.

- This criteria does not fit private land of lower class soils as in the special areas or the eastern irrigation district (Brooks). We are finding that the surface soil designation works better.

- There are several reasons for not stripping organic soils in muskeg or slough:
    1) When the organic layer is disturbed you lose all tensile strength within the layer.
    2) It will require larger borrow volumes and therefore will result in larger borrow areas.
    3) The clay layer will now lay lower into the organic and may impede subsurface drainage.
    4) Lease sizes would have to be increased to allow for peat storage.
    5) Peat stored for many years will tend to dry and be susceptible to wind erosion.
    6) Organic material is not a good soil medium. Muskeg areas should not be compared to a control other than to compare equivalent land capability. If the organic/texture/potential land use/or CLI classification is equal to or increases from the original then site should be acceptable.

- Winter Construction: Required topsoil and subsoil recovery are inherently difficult in winter construction conditions. Expecting all sites to be constructed in dry, summer weather conditions is unreasonable and impractical.

- Problems with interpretation of soils and soil profiles by inspectors due to lack of experience or soil science education.

- Old construction sites may not have any topsoil for redistribution as soil conservation was not an issue 30 years ago.

- In the case of agricultural land there is significant importance placed on soil chemistry and properties as well as actual topsoil depths when a previous wellsite is inspected. In order to remediate effects resulting from onsite activity during the production life of a well, it is often necessary to "import" topsoil from offsite locations to obtain the desired soil quality, etc. This is counter productive if preservation of topsoil as a resource is a global objective.

- The choice of available alternatives to increase the organic matter in the soil is limited by the very nature of what one is attempting to accomplish. Several reclamation offices further restrict the options by limiting the use of manure, especially if it is not completed rotted. There are not practical or cost effective alternatives unless one considers hauling in topsoil from offsite as a viable alternative. Manure will improve soil quality in a sustainable fashion. The quantities that must be added necessitate this approach be carried out over several years (2 to 6) depending on the problem being addressed. This alternative should be encouraged as it is a true example of recycling and the issue of compensation should be addressed so that this extended reclamation option does not become cost prohibitive due to lease payments.

- Recommendation: There should be provisions for long term remediation which would include addition of organic amendments, fertilizer, other chemical amendments etc. over a sufficient number of years for these amendments to rectify the problems identified, without the operator having to maintain full annual lease payments while this process is going on.

- The extent of admixing (less than 20% subsoil) allowed is very subjective – tends to be interpreted by reclamation officers as any admixing causes failure to meet the criteria. Some admixing will invariably occur when subsoiling is used to address compaction, even though the correct equipment is being used and soil moisture conditions are acceptable.

- The definition of topsoil is always downgraded to something less than original on a lease site. In original drilling and construction of pad and road and replacing horizons for duration of lease, ripping up, dozing and recontouring, mixing always takes place. After reclamation loam best describes what is on top.

- We have an example of a lease and access road which have been reclaimed to the point of requesting a reclamation certificate within a year of drilling. The lease and access road were fenced to achieve this timeframe yet the landowner has opened the gates allowing cattle access to the new grass during wet conditions causing compaction and a rough surface.

- We have an example of a lease which has been reclaimed and was producing to equivalent land capability yet reclamation was denied due to compaction. The lease was sub-soiled to reduced the compaction but the following crop was less than that of equivalent land. Perhaps a great deal of the compaction measured in the fall is due to summer rainfall.

Consultant Responses:

- Pre-Disturbance Information and Planning: Many of the problems in certifying reclaimed wellsites result from the soil materials not being handled properly during construction. I strongly believe that a thorough investigation of the soils to the depth of the disturbance and a sound material handling plan is necessary prior to construction of a well site. An urgent need for soils training of personnel building or supervising the construction of sites. My personal experience has been that many of the operators have never been shown some of the pertinent characteristics of a specific soil type and therefore costly mistakes are made simply because of a lack of knowledge of the soil environment in which construction is taking place. I personally have seen bulldozer operators salvaging the dark colored Bnt horizon of a Solonetzic soil along with topsoil. They were simply told to salvage all the dark colored upper material. Such a wellsite would require a great deal of reclamation effect and money to be reclaimed properly for certification. It is in the best interests of industry to have thorough soil investigations of the proposed wellsite and sump location prior to construction.

- A better way of conducting the topsoil depth and quality survey on a private land access road would be to reduce the number of sample points from every 30 meters to every 100 meters (on access roads less than 200 meters in length set a minimum number of sample points i.e. 4 points). The minimum requirement at each sample point (every 100 meters) should be to obtain information across the access road, i.e. each ditchline as well as centerline (3 points) and an adjacent control for comparative purposes rather than down the middle of the route used. Emphasis should still be on the sampler to adjust his points according to terrain changes rather than by distance alone, i.e. top slope, mid-slope, bottom slope. I feel that the methodology above would give us far more usable data to evaluate an access road than the method presently used.

- Some certification criteria ignore inherent soil characteristics. Mixing of upper horizons may be undesirable in the Black soils but often is a benefit in the Gray Luvisolic soils (salvaging and mixing of the L-H, Ae, AB and a portion of the upper Bt horizons is more beneficial than just salvaging and mixing the L-H and Ae horizons). Although it is convenient, from a regulatory position, to have general overview assessment criteria for the entire province or even for each Soil Zone, ultimately each individual reclaimed wellsite must be assessed on its own unique characteristics and merits.

- Topsoil Sampling Densities Should be Reduced: Wellsite - 20 x 20m grid on 100 x 100m 1 case requires 25 samples with 10m off-set. 25 x 25m grid on same size 1 case requires 18 samples with only 12.5m off-set. Savings 33% in time and expense. Access Roads: Private and public cultivated at 30m intervals is unrealistic.

  1/4 mi. road = sampling lease (1/2 day field time)
  1/2 mi. road = 2 x lease (1 day field time)
  1 mi. road = 4 x lease (2 day field time)
  Public, uncultivated at 250m intervals is impractical in muskeg.
  Potential solution: Wellsites (private and public, non-forested) 25 x 25m grid with additional samples if requested to characterize problem sectors. Public, forested - 5 samples for lease.
  Roads - Private and public cultivated at 100m. Public uncultivated at 250m if grade road constructed and no samples if no road grade.

- Wellsites Constructed Prior to 1982: Although an attempt was made to have a different set of certification rules for wells constructed prior to 1982, it would be virtually impossible to obtain a reclamation certificate for a well constructed prior to 1982 in which topsoil was not salvaged during construction, using the proposed criteria. If no topsoil was salvaged prior to construction the reclaimed wellsite will have no topsoil at the surface and it will be impossible to meet the proposed criteria for topsoil quality and quantity unless topsoil is brought in from another area. I think that we have to be more lenient in certification of wells constructed prior to 1982 in which topsoil was not salvaged. I believe that some soil properties will have to take a back seat to other properties or factors, in certification of these wellsites. Instead of keying on topsoil quality and quantity we should be assessing other factors such as: vegetative growth, salinity and/or sodicity, surface debris, active erosion, poor drainage, and possibly compaction. Let's face it, if topsoil was not salvaged for replacement during construction, we're not going to get topsoil back on the surface of these wellsites, but I think that it's time that some of these wells were certified after a reasonable effort to reclaim.

- Wellsites Constructed After 1982: I agree that a different set of certification rules should be applied to wells constructed after 1982 when the surface material or topsoil should have been salvaged, however, I believe the proposed criteria are far too stringent. It may be possible to return 80-90% of the topsoil in areas that have 50cm of topsoil (you always lose at least 10% of thickness), but what about areas that only had 10cm of topsoil? It is very difficult to salvage 10cm of topsoil with bulldozers and graders and invariably the topsoil is over-stripped. With the proposed criteria these wellsites would never be certified. Any time you salvage and replace topsoil with bulldozers and graders there is some mixing with subsoil and some loss. Topsoil was not laid down with a bulldozer and we can't expect it to be removed and moved around without some degree of mixing or loss of thickness. The question is how much loss or mixing do we allow? A 30% loss of topsoil may not be a problem in areas that have 50cm of topsoil but may be a serious problem in areas that have only 10cm of topsoil.

- Topsoil/Surface Soil Replacement Depth: Concept of adjusting limits to reflect construction dates and land classification are acceptable. Special consideration should be given to the need for replacing topsoils on percentage basis when depths exceed 45 cm, i.e. use existing criteria or maximum of 30 cm. Similar limitations on % for thin topsoils, i.e. use existing criteria with minimum of 5 cm.

- Topsoil/Surface Soil Quality: Need to remove the 100% pass requirement for all sampling sites, i.e. all criteria should be met at 80% of the total sampling points provided no negative impact on vegetative growth. Admixing - need method to evaluate accurately or increase limits. Layering - need clearer definition or omit. Salinity - omit visible salts or utilize EC measurement. Amendments - Need written definition of what are acceptable and how much can be used as topsoil alternatives to avoid time contacting RO on individual sites, i.e. 2:1 manure, peat, sewage, sludge topsoil replacement ratio.

- Subsoil: Coarse Fragments - Again need volume/size adjustment scale like topsoils.

- A total of 79 post reclamation assessment files were reviewed. Of these 79 it was determined that 25 (32%) of these were clearly pass or fail situations (15 passes and 10 failures). The other 54 (68%) were sites that failed criteria, but appeared to be in reasonable condition in relation to the surrounding area. Analysis was conducted on the data for these 54 sites. Criteria parameters were compiled to identify reoccurring problems or trends and to isolate those criteria. It was observed that the majority of the disputed sites failed certification due to either subsoil compaction or admixing.

Parameter	# Locations Failed
Subsoil Compaction	39
Admixing	28
Surface Compaction	7
Stones	5
Topsoil Depths	8

Of the 39 failed sites in which compaction occurred, only two showed any vegetation problems. Of the 28 sites with noted admixing, only four showed any vegetation problems. This leads us to believe that in these cases, the soil capability may not necessarily be adversely affected, and criteria changes may be warranted with regards to these two parameters.

- Solution: Under current criteria, if compaction or admixing is evident on any sample site, the entire lease fails. This occurs regardless of the vegetation establishment and without evident of rooting restrictions. Consequently, a number of productive sites will fail to meet criteria. A possible solution may be to monitor for these parameters, but to fail a site for compaction or admixing only if the vegetation is visibly adversely affected. In other words, soil quality or compaction alone should not determine the fate of a site, unless the vegetation is visible suffering.

- Argument: One opposing argument to this solution, for various legitimate reasons, such as climate, fertility, agronomic practices, etc., may be that effects on vegetation may not become apparent in the first year. In some cases these arguments are valid, however, it should be noted that a protection device, if necessary, is in place for the landowner. According to AEEPA regulations, the reclamation certificate allows the landowner a 5-year period following certification during which the lessor can be held responsible. If adverse effects caused by the operations do not show up within the 5 year period, it is unlikely that construction reclamation activity has decreased the soil capability of the site.

- Language: The descriptive terms used to describe the different layers of soil, i.e. topsoil, subsoil, are not consistent with the Canadian System of Soil Classification and can be ambiguous. The term "topsoil" is most often associated with a dark colored surface horizon by most people and generally does not create any problems. The use of the term "subsoil" can, however, cause some confusion. Is subsoil all B horizons excluding parent material (C horizons)? Or does subsoil include C horizons? In discussions with some oilfield construction contractors there seemed to be some difference of opinion on this. Using the basic definitions of A, B and C horizons as described in the canadian system of soil classification would alleviate any confusion. This system standardizes the language between soil survey information used in pre-construction reports and those involved in reclamation.

- In the guidelines a textural triangle is given to represent texture classes. This triangle is in fact a family particle size classification which is usually used to describe the overall percentage of particle sizes of a soil and not the texture of an individual soil horizon such as the A horizon which is the most scrutinized horizon. The texture class triangle would be more appropriate for describing texture in "A" horizons and determining any textural changes that may have occurred due to disturbance. The texture class triangle is also the accepted method for describing textures in soil classification.

- While our data base is not sufficiently broad to draw any scientific conclusions in this matter, an opinion is rendered based upon field observations and experience.

- In the course of stripping or double-stripping a lease site, contouring it, stockpiling the topsoil and later reversing this set of operations it seems almost inevitable that some topsoil will be "lost". This "lost" topsoil might amount to 1" more or less. Lost may include admixing, eroding, compacting, falling through cracks, depressions, etc. If this can be accepted as intuitively reasonable as a fixed "cost" of operations, the following scenario occurs:

  Assume a 10" A horizon: Lose 1" = 9" = 90% OK
  3" A horizon: Lose 1" = 2" = 66% Fail

  Perhaps a "stretchy" measurement device should be considered to reflect this variability problem (if it is proving to be a problem). It seems probable that winter conditions are more likely to exacerbate this issue.

- Based on our review of available technology there seems, despite best intentions, to be an industry wide frustration with the ability to achieve excellence in single or double lift stripping. While attempts seem to be being made in this area, it is our opinion that further engineering research and development will be required to bring technology to the level that will facilitate adherence to proposed criteria. It is recommended that a phase-in period should be considered to give industry the time to engineer, test and adopt new technology.

- The proposed number of 25 sample sites per hectare seems a workable figure, capable of obtaining an accurate representation of the wellsite area. The number of control sites is discretionary depending on the location, but 4 sites is a fair minimum. On the access road (private land), one sample every 50 metres would be representative. A paired control for every access road sample gives accurate comparisons, but may not be a necessity. One control for every 2 or 3 sites would be sufficient.

- Topsoil Depths: In the Brown and Black soil zones the criteria set for topsoil depths has been easy to discern and works well for the vast majority of locations. In the Grey and Dary Grey soil zones however, the definition of "surface soil" has been causing some problems. The inclusion of the Ae horizon not only degrades the topsoil quality, but makes clarification of topsoil depths difficult to discern. Incorporation of the Ae horizon into the B horizon would improve soil quality. The dark Ah and Ahe horizons are more suited to be labelled topsoil.

- Topsoil Quality:The topsoil quality parameters are assessed in a subjective manner therefore I do not believe that topsoil quality alone should decide the passing or failing of a wellsite. If admixing occurs and vegetation is not noticeably adversely affected, this should be taken into consideration. One site failing topsoil quality should not cause failure of the entire lease. Topsoil quality criteria could be treated in the same manner as topsoil depth criteria, which allows a pass if 90% of sites meet criteria.

- Subsoil: Perhaps a clearer definiton of subsoil would make this assessment more universal and useful. One suggestion would be to assess the B horizon for the existing parameters.

- Ae Horizons Being Salvaged with Ah or Ahe Horizons: Ae horizons typically are poorly suited for reclamation and/or agricultural uses usually due to texture, structure, and the consequences of disturbance when wet or dry (erosion, crusting, pulverization, compaction, etc.) stripping the topsoil to the color change, the Ae horizon, and then removing the Ae horizon with any B horizon thus mixing the Ae and B horizons would involve less disturbance and handling of the soils. The effect would be to not degrade the quality of any Ah or Ahe horizon by mixing it with an Ae horizon. Often where an Ae horizon exists an underlying Bt or Bnt horizon is present. Mixing the Ae with a Bt or Bnt horizon should not degrade the B horizons and may improve the characteristics of the B for vegetative and reclamation purposes.

- Sample Size Frequency on Access Roads: The difference in frequency between sample sites on private and cultivated public as compared to non-cultivated public land is too great. On private land sampling every 30m quite often is unnecessary, a 50m interval would be adequate. Conversely sampling every 250m on uncultivated land does not give an adequate indication of soil conditions, 100m interval would give a better representation of conditions. One control site for every sample site in most cases is not required perhaps on control for every 2 or 3 sites is all that is required. As is stated in the criteria guidelines, diverse landscapes will require more frequent assessment locations. Access roads on native range which have not been stripped should require only visual inspection or sites where disturbance has taken place.

- Control Sites for Lease Area: A minimum of four control sites is not sufficient to determine undisturbed soil conditions. Increasing the number of controls to eight will provide the required amount of information to properly determine soil characteristics before disturbance.

- Topsoil Quality: The requirement that the site passes only when all the assessment points pass can be very difficult to achieve under actual field conditions. A more realistic approach would be to adapt similar requirements as those attached to topsoil quality.

- Compactness: Methodology and type of measuring device used to determine compactness should be standardized.

VEGETATION CRITERIA - GENERAL COMMENTS

Government Responses:

- Rooting - Definitions are required for the different classes of rooting restrictions.

Industry Responses:

- Weed Control: Perception is weeds must be eliminated from site, as opposed to "controlled". Totally weed free is unreasonable as some weeds are carried in naturally. The control condition should be a more general area instead of sites immediately adjacent to the reclaimed area.

- We have a concern over the wait for vegetation to be established, assessed and the application form then completed. It is our belief that by the time this new working document goes from our field personnel to Alberta Environmental Protection Edmonton and then out to the proper area office, we stand a great chance of losing that growing season. By the time we get put on a waiting list for an inquiry, we may pay another year of surface rent. We believe in a good working relationship that will continue in a good level of cooperation.

Stakeholder Responses:

- WSGA does find concern in the area of vegetation cover. We fully agree with the concept that requires reclaimed sites to be sustainable in nature or provide similar crop yields. In the area of species used to revegetate the site, it now states that revegetative species and species composition should be compatible with original or adjacent vegetation. We believe that in areas of natural or native grasslands, the site should be specifically revegetated with the same grass plants the site had originally. All too often reclaimed sites are seeded to tame grasses which, although providing adequate forage in certain times of the year for grazing animals, provide a poor substitute for long term all season grazing. Some grass plants such as timothy, brome grass, or crested wheat grass often expand into the native plants surrounding the site, becoming an infestation of unwanted grass plants. For example, in areas where the native plants are a fescue/perry's oatgrass/wheatgrass, grazing often occurs throughout the winter months. If timothy or brome grass were seeded on the site, these grasses tend to freeze off and fall down to the ground after heavy frost or snow cover, thus providing little forage to graze. Thus a high yielding brome grass may be fine for a hayfield but the wrong grass for a native plant site. WSGA recommendation, is that in areas of native grassland, the same grassland plants be used to re-establish cover on the site. We fully realize that obtaining native grass seed in Canada is difficult. However, in the Unites States, a forage seed industry has developed around native grass for reclamation requirements. Please do not import fescue or blue gramma grass seed that is native to somewhere other than Canada.

Consultant Responses:

- Have any private lands been certified without growth (written but seldom/never used)? Where contaminants have been removed need method of speeding approval. Suggested solution: Plant bioassays comparing "control" versus reclaimed areas to avoid waiting for minimum 1 year period.

- Vegetation: Percent Ground Cover: Does percent ground cover mean cover on the soil surface or cover provided by the canopy of the plants or both?

LANDSCAPE CRITERIA - GENERAL COMENTS

Government Responses:

- No concerns with any of the landscape parameters other than the double standard for private and public land with regards to coarse fragments.

- Page 9 Slopes - The 20% criteria may apply for steep slopes, however, the tolerance is too tight for slopes under 15%. For example, 20% of a 5% slope is only 1%, a value too small to be of concern or be achieved. For slopes less than 15%, a 40% tolerance would be more achievable.

Industry Responses:

- It may be inappropriate to evaluate stability on the basis of tension cracks in areas prone to soil movement if this criteria is used to require further action several years after receipt of a wellsite reclamation certificate.

Consultant Reponses:

- Contour: Should set maximum acceptable slope gradients based on future land use and landowners preference on private lands, i.e. hillside flattened may improve land use for agriculture "pad" lease left in-place forested, muskeg area may provide improved grazing opportunity for big game.

- Drainage: If quality of adjacent lands improved by altering drainage should the exact prior route be re-established?

- Coarse, Surface Fragments: Need to adjust acceptable coverage limits in relationship to size of rock and response to growth, i.e.
  - private lands - cultivated
    - 5 - 10 cm diameter allow 10% increase
    - 2 - 5 cm diameter allow 16% increase
    - 0 - 2 cm diameter allow 20% increase
  - public lands
    - 5 - 10 cm diameter allow 20% increase

- Debris: Need written standards that allow burial of clean, crushed concrete or rock at 1 to 1.5m below surface if no alternative re-use is available. Depth and size of pipeline removal and capping/purging requirements need to be specified.

POLICY/IMPLEMENTATION - GENERAL COMMENTS

Government Responses:

- I feel that the absolutes found throughout the written portion of the criteria (i.e. 100% must be more than or equal to 50%) should instead of out and out rejecting the site act as a trigger requiring a more intensive sample of the effected portion. This portion could then be assessed on it's own merit.

- Certification Criteria Applies to Old Sites - Identify those areas of concern.

- The present criteria allows for two sets of quality and quantity standards to be applied to the identical parcel of land based on ownership. In addition, there is no distribution standard for non-cultivated public land.

- The assessment differences between private and public lands should be changed to reflect differences in land use and not ownership.

- The criteria needs to recognize the different land uses (present and future) and soil types and then base the standards and criteria on those differences.

- There is a difference between the way that public and private land is used and managed. The criteria must reflect this difference. Public demand is managed for long term sustainability of multiple resource benefits. These resources include, e.g. agriculture, recreation, forestry, wildlife and watershed. Government agencies assume the "landowners" responsibility for public land, and are involved with planning, construction, operation and reclamation of public land.

- Disturbance of native prairie/sensitive areas must be minimized. It is imperative that the criteria include an over-ride of vegetation criteria over soils criteria in situations where re-disturbance of the site to improve soil quantity, quality or compaction is likely to cause more harm than good. Concerns include further degradation to the landscape through erosion, repeated disturbance to re-established native plant communities, introduction of weeds through soil amendments and equipment.

- Soil quantity and quality requirements have to be more flexible to cope with the variability of many public landscapes and uses. We cannot justify disturbing many old well vegetated sites just to "improve" soil quantity or quality.

- Water is an important basic resource that should be included in the criteria. Public Lands is responsible for managing the bed and shore of water bodies. Need to develop statements under the landscape portion of the document about protection of surface water. Issues like sedimentation need to be addressed. Agencies dealing with water contamination should be mentioned in the introduction.

- Present land use/resource management objectives are primary considerations when measuring reclamation success. Reclamation of a site will use adjacent or area land use/resource management objectives as part of the "control" for determining success. Land use/resource management objectives are considered to be criteria.

- Page 5 - Objective 3.3 could be rewritten to: "To plan and control all construction and operation activities to prevent environmental degradation and to facilitate future reclamation of the site".

- Land and Forest Services support the use of common criteria as the basis for the issuance of Reclamation Certificates in the Green Area for wellsites and associated facilities, providing they recognize and reflect differences existing across the Province. This is particularly noted on developments on organic soils (muskegs) and on sites overlying permafrost.

- Limited first-hand field experience in the use of the criteria to assess the applications for reclamation certificates in 1993. Perhaps several in industry did not feel the need to use the criteria for sites in the Green Area because certificates were being issued in 1993 on the basis of the old criteria which relied almost exclusively on vegetation and landscape stability (surface erosion, slumping and subsidence).

- Flexibility in applying full criteria in 1994 could be considered in some situations. Communication between field staff and industry should continue if we are to apply these criteria successfully.

- The major deficiency in this draft is the single mention of "water" (pg. 2, line 7). Water (surface and groundwater) should be emphasized at the same level throughout the document as "soil", "landscape", "vegetation", etc. I have written it in where I think the draft needs revision. Furthermore, I note that we need a manual on how to evaluate "water" in the field, and how to protect it.

- The criteria Land and Forest Services wish to work with should be realistic and easily applied evenly across the Green Area. More detailed comments and suggestions will be outlined at the workshop for general discussion, and will relate only to the Green Area.

- Alberta Land and Forest Services generally support the use of these criteria as the basis for the issuance of Reclamation Certificates in the Green Area for wellsites and associated facilities.

- We have had limited first-hand field experience in the use of the criteria to assess the applications for reclamation certificates. Approximately less than ten percent of applications submitted to Land and Forest Services in the past season were based on the new criteria; i.e., less than ten percent were submitted on the new form. In a year when the applications we received were low in number, that ten percent represents a low number considering the number received in a typical year. Perhaps several in industry did not feel the need to use the criteria for sites in the Green Area because certificates were being issues in 1993 on the basis of the old criteria which relied almost exclusively on vegetation and landscape stability (surface erosion, slumping and subsidence).

- We have indicated our general support for these criteria; however, there are some areas we would like to clarify for our own benefit and for the benefit of industry. We are in a unique position of being the land managers (in other words the land owners), as well as the regulator. We have come to understand that industry appreciate this, primarily because in essentially every instance they deal with only one individual who speaks as the land owner and the regulator.

- The criteria need to be realistic and easily applied evenly across the Green Area. We recognize the importance of having the criteria, and we believe the criteria as drafted for field testing in 1993 for the most part are realistic and practical. Our comments or concerns, which are general as well as specific in nature, will relate only to the green area. They are based on our very limited field experience with the criteria, and on the often very frank and open discussions amongst our staff during the field sessions of the training given by PITS.

Industry Responses:

- All inspectors must have experience such as a farm background, also have had experience running equipment so they know what can be done. They must also accept the farmer's input as he makes his living off the land, although some landowners work the system. They must be available when we need them, not next month.

- Before they pin Industry to the ground they should set an example such as roadside erosion, compacted and poor soil on borrow pits and gravel pits. Keep regulations to a level where everybody can understand them, right from an operator with a minimum of education to a university professor.

- I suggest that Industry use a step-by-step method of cleanup, documenting everything that's done also using landowner's input, soil grid, soil sampling if felt necessary, soil stripping, recontouring, replacing topsoil, seeding, etc. When this is complete, send landowner and environment a copy and at this time surface lease rent stops. Environment can check it when they're free. If they can prove beyond a doubt there's something wrong, we will return and fix it, otherwise Industry is paying thousands in lease rent on locations that are reclaimed and should be inspected and passed, but environment hasn't made an effort to get out and do it. As consultants we put in long days to get this work done in season. They should be able to make an effort to check them.

- I found that County inspectors will feel locations are fine and environment will fail them. At a PITS course environment couldn't agree, so how are we to please them. Environment must realize when virgin ground is disturbed it can't be put back the same but it can be put back to grow a good crop.

- The focus of the requested input is on the technical merit of the criteria. While these are important, the broader and more significant issue is how the landowner is compensated while the application/certification process proceeds. The objective may appropriately be to return the land to ". . . an equivalent land capability", however, it has to be recognized that the economic impact on all the stakeholders must be considered while this objective is being achieved.

- There are suggestions that the intent Section 55 of the Land Surface Conservation and Reclamation Act, which allows for the issuance of a Chairman's reclamation certificate, will no longer be available. Until the issue of compensation is linked with the reclamation certificate approval process, this option must be left open. Although it forces a landowner to choose between "guaranteed" and "fair" compensation, it does provide for occasional relief from unwarranted annual lease rentals where there is no apparent decrease in land productivity (in the opinion of and option of landowner).

- Compensation During the Reclamation Certification Application and Approval Process: Compensation to the landowner for oil and gas surface leases, as regulated by the Surface Rights Act, and the issuance of a reclamation certificate, which essentially protects the Crown from eventually being liable for the reclamation or remediation of a site, cannot be treated separately. We believe there can be flexibility in how the landowners are compensated and how the Crown is protected but the solutions must be linked in order that the operator is not unduly penalized by a protracted process in which annual lease payments no longer reflect crop loss or nuisance to the landowner.

- Payment based on the per acre open market value is paid to the landowner when the lease is first taken. In addition to "buying the land", the operator also pays an "entry fee" of $500 per acre (except on Crown land). The idea of this was to compensate the landowner for the "forced entry". Neither of these payments are considered when the reclamation criteria are implemented at abandonment, i.e. reference to " . . . sustained levels of use at least equivalent to those which existed . . " implies the condition after abandonment must be as good as or better after reclamation at abandonment even though the landowner has been compensated for the land on the basis that it was sold.

- Annual compensation (lease rental) paid to the landowner, which originally was meant to cover noise, traffic, inconvenience, loss of production, right of access, etc., is not reduced when the various factors are no longer "active" concerns.

- Recommendation: The reclamation officer should be able to issue a reclamation certificate based on observed vegetative growth, soil characteristics or other criteria set out in the regulations. In the event that future productivity is not consistent with adjacent production, the operator should be responsible to remediate the problem. In the interim the operator should not be obliged to pay full rental while the question of land capability is being demonstrated, a process, which by its very nature may take several years depending on weather conditions, crop rotations and other factors outside the operators or reclamation officers control, and which can be delayed significantly by certain legitimate practices the landowner may choose to take (e.g. summer-fallowing).

- All or Nothing Bias in System: There are no provisions for issuance of a reclamation certificate without releasing the operator of the responsibility (liability) to remediate future problems. Consequently . . . The need for a reclamation officer to ensure there will be no problems appearing after a reclamation certificate is issued causes them to be ultra conservative when issuing a reclamation certificate to avoid the possibility that the Crown may have to rectify problems.

- The present system (and the proposed amendments to it) work to the advantage of the landowner who is prepared to "give and take" in their negotiations. This is because compensation is an "all or nothing" arrangement rather than being based on what the actual inconvenience, nuisance, and loss of productivity are to the landowner. Recommendation: Compensation should be proportional to the crop loss and effect on the landowner's operation. There must be provision for lease rental to be reduced while the operator and the system proceed with the rec. certificate application and approval process. The system put in place must have a balance that protects the right of the landowner to ensure his land is appropriately reclaimed without affording him the opportunity to obstruct the process in order to maintain receiving the originally negotiated annual lease rental.

- Compensation Alternatives: There should be provision to compensate the landowner for marginal deficiencies in meeting the criteria thereby allowing the issuance of a reclamation certificate. This could be used in cases where the landowner can best address the deficiencies (and agrees to) and where ultimate productivity is not affected, that is, persistence of the problem does not cause further deterioration in soil quality (e.g. stoniness of a lease).

- Other Concerns: On occasion easements are taken for pipeline crossings, etc. through an areas where a reclamation certificate has been applied for. In this case the reclamation officer will not issue a certificate until concerns within the easement are addressed to the same standard as the original lease for which the reclamation certificate was requested. This is the case even though the latter activity may be associated with a different operator. This secondary activity should be treated separately.

- From the time a site is reclaimed and if finally is inspected for pass or fail of environment criteria many factors can enter into what happens to the lease. The people with the least control is the industry that did the reclamation. (However, all the onus is on them to do something to rectify).

- The formation of the Construction Superintendents Committee was brought about by the need for operational input into the criteria. It is imperative that the industry receive equal representation at the January Workshop in order for the concerns expressed by all parties at the Red Deer Conference be dealt with and hopefully resolved. The industry has not had sufficient input up to this stage and is now actively involved in making this process work. An opportunity such as the one that presents itself to both parties now should not be missed. The industry supports the need for criteria, but supports a criteria that are workable.

- The economics of implementing the criteria must be examined and justified. At a time when sustainable development issues are prominent, we must ask if we are wasting valuable resources for a minimum improvement.

- The need for up-front planning on new drilling sites is recognized. Now that the target is defined, we are directing our efforts from the initial survey stage to meeting the reclamation criteria.

- As the information required will be quite comprehensive and involve significant input on the part of the applicant, it is expected this will expedite the Certificate of Reclamation process and serve to substantially reduce ongoing Surface Lease Rental Fees and other similar expenses.

- The timing of bringing the criteria into full use in the 1994 season is premature. At the very least the criteria should be interim in 1994 and revised in January of 1995 before coming into force. This will allow more time for effective feedback from the regulators.

- Wellsite pads should be allowed to be left in place in muskegs and sloughs rather than removed. The criteria for leaving a pad in place is as follows:
    1) Does not interfere with subsurface drainage.
    2) Does not adverse by impacting future land use.
    3) Requires permission from the landowner.

- In general, we could not come up with any major criticisms of the technical aspects of the criteria, and the application process for new locations is quite straightforward.

- It is too soon to comment about the actual assessment practices, as there have been no inspections by the LCRC on any leases that ATCOR has applied for under the new guidelines. This is not likely to happen until late next summer based on the present response time.

- Given the greater amount of time and increased cost involved in performing the assessment procedures, it is my hope and expectation that the LCRC will be able to deal with these cases in a timely manner and that the Reclamation Officers will allow some measure of flexibility and latitude in interpreting the guidelines.

- Timing: Difficulty perceived in scheduling initial inspections in a timely manner with reduced manpower in AEP.

- Difficulty perceived in scheduling inspections with crop cover.

- Criteria Tolerance: There is a perception that the specified tolerance does not allow Rangers to use judgment regarding the best process to reclaim old production sites, e.g. restripping sites that already have established tree growth in order to meet initial contouring conditions.

- Criteria are still open to subjective interpretation and, as a result, determination of site conditions are inconsistent.

- Criteria Flexibility: Criteria flexibility in recognition of variable natural environmental conditions may be apparent globally but not within individual sites. Natural variations do occur at this level, e.g. topsoil depth on foothills sites is highly variable within the boundaries of the site, and within the 4 control sites. How is the appropriate replacement depth to be determined in this case?

- General: Shell strongly supports the vision of promoting and encouraging environmental awareness and planning. The intent of the Reclamation Guidelines, which is clearly to maintain sustainable operations, is realistic and necessary. Shell believes there is significant value in utilizing the "working document" for the 1994 season, to allow input from additional field experience, before the reclamation guidelines are finalized.

- Benefits: Outlines and defines expectations and required objectives for reclamation requirements. Should result in less controversy between RO, land-owner and industry after all concerned parties are educated and criteria concerns are resolved.

- Concerns: Lack of, or inability for flexibility of inspectors ("common sense" not always present during site inspections in some areas). Lack of RO inspectors (some sites waiting 2 or more years for inspection). Change of inspectors during reclamation process. RO inspectors not available for on-site discussion prior to construction or reclamation. Inconsistency of RO inspectors between areas.

- Suggestions for Improvement of System: Use certified third party inspectors paid by industry or RC permit fee, contracted as required so that RC applications are addressed within 30 days of receipt. RO inspectors to be made available for on-site discussion as required prior to construction and reclamation.

- The current volume of abandonments and reclamation appears to exceed the volume of reclamation inspectors available.

- Reclamation inspectors should have reclamation experience and an agricultural background.

- Reclamation inspectors should be available for consultation because their after inspection requests often require significant unreasonable additional expenditures.

- Reclamation regulations should be written at a level that does not require a degree in agriculture to understand.

- Reclamation inspectors should take into consideration the landowner's recommendations. We have an example where the landowner has indicated to our reclamation consultant that the lease is totally acceptable, yet the reclamation inspector's investigation indicated equivalent land capability has not been achieved.

- Placing percentages on or by year of construction (i.e. 1985 topsoil quality has to be 8cm to 10cm original or 80%). These are very nominal values and experience and discretion must be used by reclamation officer.

- In the case that there isn't enough topsoil to meet the requirements on the above what should be done? At present a lot of topsoil is being transported from title to title against the Alberta Legislation. Also many landowners get very unhappy with bringing in contaminated soil.

- The criteria are currently based on a pass/fail grading system which is prohibitive in cost when considering the high number of sample sites required. Only the most recently constructed well sites will easily meet the criteria. Consideration must be built in to the criteria for the age of the site. Older sites being farmed to the wellhead currently require the same sampling regime out to the original lease boundary, even though crop yields are similar on and off the lease. Some older sites on marginal land show a good catch of grass, but may have admixing, contouring or compaction problems. Is it justified to destroy the existing vegetation cover and risk no growth for another 5 years? The revised criteria should be field tested for one more season before they are finalized.

- In the past we have told all officers not to hold any of our inquiries until we give notice that all parameters for a pass are met. This has greatly increased our success rate on inquiries so why argue with success. Would like to continue this way through the transition until the back log is cleaned up.

- Why not have only one person doing the certification instead of a local member and a reclamation officer. Government could make better use of the extra person in these days of cutbacks. We could use the extra inspections to clean up some of the work load.

- Perception that re-inspection after initial "fail" will potentially be several years later.

- Liability/Accountability: AEPEA dictates the Government Representatives will be liable for deficiencies along with the Operators and others. The incentive then may be to fail everything as a protective measure.

- Current proposed criteria cannot be met on sites constructed during the winter months. Cost of reclamation to meet the new criteria, on some sites, cannot be justified. Oil industry being treated differently (more severely) than logging and farming industries.

- Inspections of White Area Public Lands completed in 1993 were passed or failed based on "New Criteria" regardless of when the reclamation had been completed.

- Separate criteria for Public Lands in the Green areas and Private Land.

- One more season to test and fine tune the criteria prior to finalizing the regulations.

- Flexibility of criteria is required (100% pass of all criteria on older locations cannot be achieved without topsoil replacement and/or other amenities).

- Provisions for negotiated approval for a Reclamation Certificate on sites where excessive reclamation costs cannot be justified by the end result.

- Timeliness: There is often a delay of several months to more than one year in conducting the first inspection or inquiry necessary to ascertain whether or not a reclamation certificate can be issued. This results in annual lease payments being maintained even though the operator has done everything required.

- When the reclamation officer for an area changes it is common practice for him/her to take some time to familiarize themselves with the area, landowner specific problems and concerns, and the operators they are dealing with. This causes significant delays in granting reclamation certificates.

- The criteria appear to be too stringent and at the same time are very subjective. It is quite probable that two professionals may assess the same site differently based on the same criteria.

- Fundamental principle: Any changes caused by project activities should be measured against the original site conditions.

- Criteria describe allowable changes to landscape - soil - vegetation.

- How Can we Best Meet the Established Criteria? The criteria general philosophy upon which the Act appears to be based are opposed to one another. Whereas the Act appears to have environmental protection and sustainable development as goals, it recognizes there will be environmental disturbances and these will have to be corrected, while the criteria make no provision for remediating problems, e.g. there is no recognition that the most desirable option may be to remediate in place. These criteria focus only on correcting the regulated problem, with no consideration of how that goal is reached. The current regulations make it almost necessary to "steal" from the non-regulated area to repair the regulated problem. More consideration to longer term solutions (i.e. in situ remediation), tied to the compensation the landowner will receive while the program is being implemented.

Consultant Responses:

- Every effort is made to contact owners and/or occupants for permission to take offsite samples for controls. However, on those occasions when it can't be arranged, it would be comforting to have some legislative assurance that, like Alberta Land Surveyors, one is not considered to be trespassing if taking a soil probe outside the lease boundary.

- The opinion is rendered that some sites are much better left undisturbed rather than opening fragile systems to various negative forces. Some compaction on a prairie trail might be more desirable than erosion, weed infestation, etc. At minimum, some thorough discussion of this issue is encouraged.

- Given the difficulty Reclamation Officers appear to be having in getting to all the site inspections, it seems unwieldy to require them to add inspecting and approving amendments to their agendas. Put the onus on the resource company to handle this one.

- It is considered desirable to better define permissible mix bury and cover options, materials, etc., including old attempts at handling drilling wastes.

- Evaluation of Criteria is Premature: Combination of factors such as unusual weather, late evaluation of criteria, need to complete field work then wait for growth, work load of RO's etc. has limited the number of sites which have been both reclaimed and inspected using the new methods/procedures demanded by the new criteria. While several sites have been inspected using the new criteria many of these sites were not reclaimed to meet the new standards. Consequently, the "jury is still out". Solution: Wait until spring of 1995 to finalize new criteria after compilation of success ratio.

- Changing Rules (Criteria) by Soil Zone: I strongly believe that we need a different set of rules (criteria) for different regions of the province. These regions could simply be the various soil zones although it is recognized that different soil types occur within each soil zone. Brown soils have quite different characteristics and properties than Black soils, and Black soils are quite different than the Gray soils. In Gray soils that are not cultivated, the upper material is mainly Ae horizon material. Perhaps in these soils our criteria should be directed towards surface texture, rather than the quality and quantity of "topsoil". When Gray Luvisolic soils are cleared of their native vegetation for cultivation, the original L-H, Ae, AB and sometimes upper Bt horizons are mixed and developed, with time and cultivation, into an Ap horizon. The Ap horizon generally has similar texture as the original Ae horizon which is a more favorable texture for cultivation than an underlying clay loam to clay textured subsoil. Retaining the favorable surface texture for future agriculture is probably a more important criteria in these soils than other soils of the province. Consideration should be given to changing the emphasis of specific criteria for the different soil zones or regions of the province.

- New Criteria Are Not Universally Applicable for Public and Private Lands: The concepts embodied in new criteria are generally acceptable for high-value agricultural lands with some modification. Most respondents felt separate criteria needed for forested, public lands.

- Rational: The time and expense of reclaiming Class 5 and 6 lands cannot be the same as high valued, prime agricultural lands. Many of the RO's responsible for forested lands are not applying or considering the new criteria for those areas. Same reclamation criteria should be applied to forestry management companies and other government departments (i.e. highways) as to oil and gas sector.

- Potential Solutions: Less rigorous requirements: for sampling densities, rock removal, re-contouring of well-vegetated older sites and topsoil replacement on forested lands.

- Method Needed to Obtain Rapid/Timely Input from RO's on Unspecified Issues: When improvements (i.e. roads) are to be left in place at private landowners request/agreement there are often conflicts with RO demands that holds up field work for months. Need a set of guidelines to establish what improvements are acceptable, in what state improvements must be left and who has ultimate decision on leaving or removal.

- Potential Solutions: At least one full-time RO contact in regional office so people can schedule meetings and resolve issues in predictable manner.

- Time Delay on Inspection Must be Improved: RO's overloaded - need help. Solution: Application fee charged used to hire contractual or more government RO's.

- Need to Have All Stakeholders Present During Inspection: Many RO's inspecting sites without third parties. Potential solution: Advanced scheduling of 14 days or more.

GENERAL ISSUES - APPLICATION FORM

Government Responses:

- With respect to the format of the application form I feel a standardized, field orientated work sheet should be added. This would provide room to properly record all your observations at each sample point. This should not be left up to industry, but set up by ourselves to assist us in evaluating how the applicant came to his/her conclusions. We could also use the same form to prove or disprove a controversy. Once the field data is collected a brief summary check list should be provided starting with the most limiting factor and walking through the criteria, i.e.
    1) 100% of the samples must be more than or equal to 50% of control depth.
    2) Replacement topsoil depth must be: 90%, 80%, 70%, etc.
    3) No two sample plots with less than 80% of the replacement depth may be adjacent to each other, etc.

- Application Form: Site data - the topsoil/surface soil depths (cm) section is inadequate. This is the main information that will be used at the field level, it will be referenced frequently during an inquiry and should be on a separate sheet.

- Certification Criteria: Needs to be rewritten to be more user friendly. Methodology should be separated from the criteria and definitions should be supplied for some of the parameters and classes in the criteria, i.e. layering (no difference in extent, evident difference, obvious difference).

- The practice sheets groups were given to put their information on were poorly received. Many felt that the criteria should be written in such a fashion as to say exactly what it means. Many individuals felt that the criteria in many areas is too vague and is open to too much interpretation.

Stakeholder Responses:

- One area that I feel it is weak in is the landowner relations. There should be a signature required by the owner to show that he has been contacted by Alberta Environment prior to the Wellsite being signed off. In this way the owner would know it is being written off and also that he is satisfied with the manner in which it was done. The owner is required to sign the initial contract to commence construction unless it is done under a board order so I feel that they should sign it upon completion.

- As a whole the new reclamation criteria, as outlined in the 1993 working document, is a major step forward in land restoration and reclamation. Western Stock Growers Association (WSGA) commends the Land Reclamation Division of Alberta Environment for their initiative on the working document. We are very pleased with the "leave it as you found it" attitude taken throughout the document. In particular, the soil sampling and analysis before any disturbance and after reclamation will go a long way to improving the site and thus improving long term relations between the private landholder/disposition lease holder and industry.

Consultant Responses:

- I have reviewed the draft criteria for Certification of Reclaimed wellsites and feel that the criteria are far too stringent and too subjective for certification. I also feel that there is a problem using qualitative estimates for regulations with little or no tolerance.

- Signed Declaration: How can anyone with any credibility sign the Declaration (on the last page) that there are no chemical or physical conditions on the land that will affect soil, vegetation or groundwater on or near the wellsite when soil investigations are only to a depth of 70cm. I can see some long and prolonged court cases resulting from such a signed declaration. Groundwater and the actual sump (which may be to a depth of 3m) are not investigated and therefore there is no way one can determine if there are contaminants at depth.

- Need Written, Consistent Standards for Contaminant Remediation Under Level II: Everyone is using different standards. Depth of investigation must be specified. Hydrocarbon residuals, i.e. ERCB "pits/ponds" regulations allow 1000 ppm O/G for direct burial. CCME (M.U.S.T.) allows variation of 40-400 ppm TPH & TEH depending on end land use. Alberta Tier 1 at 40 ppm (TEH). Salinity - ERCB pits/ponds allow 12 ds/m direct burial, land farming much achieve 4 ds/m. CCME varies with end land use 2 - 4 ds/m. Tier 1 - EC 2ds/m. Level II (LCRC) new criteria 2-3 ds/m. Metals - CCME, Tier 1, Level II (none). Sterilants - Not listed in any standards.

- Potential Solutions: Relate residual contamination to future land use, Tier II approach too costly and time consuming. HC allow conc. to vary with C# and relate to bioavailability or water solubility, i.e. C - 8 = 60 ppm, C 8 - 20 = 500 ppm, C 20 + = 1000 ppm using TEH 1 component analysis. Salinity - EC above background soils with upper limits appropriate for future land use. Metals - Bioassays of soils. Sterilants - get acceptable written standards based on plant bioassays for various crops/grasses.

- Added Costs of Meeting New Criteria are Affecting Economic Health of Companies: Estimated 10-20% increased costs landscaping/soil replacement requirements. Contamination can increase costs by

100-500%. Site assessment (before and after) costs have increased $200-$600/site. Potential solution: Amendment to surface lease agreements after physical reclamation work is done and awaiting final inspection (i.e. compensation limited to full value of crop grown on equivalent area of adjacent land or a straight fractional reduction (25%) of original lease payment.

- Post site assessments should be correlated more with the lease plan (plan showing locations of sump, flare pit, tanks, well center). More effort should be spent on controls for lease construction - pre-site assessments, (it is difficult to remediate excessive mixing and too late after the fact). Pre-site asessments should be consulted with site construction crews to avoid costly and unnecessary reclamation procedures.

- Methodology: The methods and equipment used in the field by those involved should be standardized to minimize discrepancies that may arise due to different investigative techniques and equipment. The reclamation officers especially should be required to follow standardized field procedures due to the fact that any one company is usually consulting with several RO's throughout the Province at one time. This would facilitate an improved flow of information between RO's and company representatives.

APPENDIX 'K'

WELLSITE RECLAMATION CRITERIA: ALBERTA GOVERNMENT UPDATE

Wellsite Reclamation Criteria Comments

Issue	Comment and Suggested Changes
	Criteria Package - General
General Comments	We agree that the form can be submitted with explanation as to why it can not be filled in with all "Yes". **BUT** industry must strive to meet the criteria, not to aim for the exemptions. We expect a **very small percentage** of the sites to require the exemption. Need an exemption for well-vegetated sites; we won't go in and disturb these to fix a soil or landscape problem (unless a hazard). See the exemption in Landscape-Contour. Flag that we do not condone using soil from an undisturbed area to fix up a site. They may use soil from an area to be disturbed (e.g., construction site) or an existing disturbed site (e.g., wind-blown topsoil on a fence line). State that we are concerned with off-site damages and that these will be addressed by other means (e.g., requests to repair or EPO's if necessary). The Reclamation Certificate will be held up until the off-site damage is repaired (this is required to guarantee access to the site for repairs). Need a better term than "improvements" on the form or "facilities" in the criteria. Suggested "facilities/exemptions". Concern is that some of the things left on-site are not really "improvements" or "facilities", they are really just an exemption to the rules. Identify that these facilities/exemptions must not cause off-site damage or be a safety hazard. State that no practices should lead to future instability (e.g., burial of wastes or debris). Recommend pre-disturbance assessments for topsoil/surface soil depth to aid in stripping. Need a list of government contacts for chemical problems, water problems, problem identification methods, etc. Need a Glossary.
Contaminants not addressed in the criteria	Leave as is but add "salts" to the list of items covered by the term contaminants.

Wellsite Reclamation Criteria Comments	
No sampling or analysis required	OK but clarify that "sampling" means sampling for analytical work. You still have to do field assessments.
Second inquiries receive lower priority	Not a rigid policy for all sites. If the site only requires minor cleanup to meet the criteria it can be dealt with as time permits. Some suggestion that work that can be completed in less than one (1) year is "minor". Maintain flexibility and common sense. Don't want to penalize the operator who really tried to meet the criteria. On sites that obviously fail the criteria or where totally inadequate assessment occurs, we will return the application and require re-application. Need consistent policy for all agencies.
Time and cost to undertake the assessment	Generally feel that this will decrease as government and industry get familiar with the criteria. We need to develop confidence in the various companies and consultants.
Different criteria for private and public land	Lots of discussion. Keep as is but need to better define words (e.g., "cultivated" for public land means annual cultivation). Concern about "potential" land use (e.g., public land to be sold) is only an issue for the fringe areas and relates to a very small portion of the sites we deal with.
Criteria Package - Level I	
Level I criteria vs. Level II criteria	Suggest we remove Level II from this package. Will need to develop a more detailed package for Level II to include such things as sampling, analyses, etc. Suggestion that Level II is almost automatic for battery sites (strong likelihood of chemical contamination).
Landscape - General	Sedimentation into surface water is a concern and will be dealt with through off-site damage (see above).
Landscape - Drainage	OK. Some discussion regarding clay pads/roads in place - we need to identify that they can not cause off-site effects.

Wellsite Reclamation Criteria Comments	
Landscape - Erosion	OK as is.
Landscape - Contour	OK as is. Move the exemption for well-vegetated sites to the beginning of the criteria to cover off a number of the criteria where this will apply.
Landscape - Stability	OK as is.
Landscape - Coarse fragments	Leave as is for private land but add "... and cultivated public land". Change to 20% for public land. Flag that coarse fragments can not be concentrated or piled up in one area.
Landscape - Debris	OK as is.
Topsoil definition	Revise to read: All A-horizon (Ah, Ahe, Ae, AB, Ap) materials, and the Bm-horizon in Brunisols, in the soil profile. The quality of the AB or Bm horizons (e.g., acidity, sodicity, or texture) must be favourable to warrant salvage. Ae and AB horizons may be salvaged with the rest of the A-horizon or may be separately salvaged. Keep the organic description as is but flag that the Conservation and Reclamation Inspector may waive in certain cases (e.g., where a road/pad is built on muskeg). But, must make it clear to industry they will still have to create a suitable rootzone on these sites.

Wellsite Reclamation Criteria Comments	
Surface soil definition	Revise to read: The uppermost mineral and organic soil materials (to a minimum depth of 15 cm of mineral soil), or soil salvaged to a specified depth, which is valued as a growing medium. The salvaged soil must include all A-horizon materials, and may include all or part of any organic (LFH or O) horizons or part of a suitable B-horizon.
Topsoil/surface soil sampling scheme	OK as is.
Access road sampling scheme	Base it on the length of road. For ⟨2 km, use one every 100 m. For ≥ 2 km, use one every 250 m. Set a minimum of two (2) sites for very short roads (entry to site and entry to main road). Sample ditch, crown and control at each site. Should encourage the company to sample the two ditches in alternating sequence.
Control site sampling scheme	OK as is.
Topsoil/surface soil quantity - % average depth replacement - number of sites allowed to have less soil than average	For surface soil, use: 1993 and later the Average Required Depth (ARD) is ≥80% of control. For 1983-1992 the ARD is ≥60% of control. For pre-1983 we will rely on vegetation for the assessment rather than on soil depth. For distribution, use: 80% of the sample points must be ≥80% of the ARD. 100% of the sample points must be ≥40% of the ARD. The Conservation and Reclamation Inspector will be looking for the material described in the surface soil definition (e.g., A-horizon material) when evaluating the depth. For topsoil, delete the requirement for ≥50% ARD on CLI 5 and 6. Recommend distribution be ≥80% of ARD for all sample points. Suggest that we develop a series of diagrams to show what we mean by ARD and variability.

Wellsite Reclamation Criteria Comments	
Topsoil quality - measurement methods	For White Area Public Land surface soil add: Texture should remain in the same texture class when comparing on-site vs. off-site and within the site. For topsoil:
- % admixing	OK as is.
- texture triangle	Use the normal texture triangle.
- aggregate size	OK as is.
- aggregate strength	OK as is.
- layering	Delete (see Soil Profile Assessment).
Topsoil/surface soil - salinity	Delete.
Topsoil/surface soil - coarse fragments	For Non-cultivated Public Land, use 20%. OK as is for Private Land and Cultivated Public Land.
Topsoil/surface soil - compactness	Delete (see Soil Profile Assessment).
Subsoil sampling scheme	Delete (see Soil Profile Assessment).
Subsoil - salinity	Delete (see Soil Profile Assessment).
Subsoil - coarse fragments	Delete (see Soil Profile Assessment).
Subsoil - compactness	Delete (see Soil Profile Assessment).

Wellsite Reclamation Criteria Comments	
Soil Profile Assessment	Use the attached data sheet to assess the physical characteristics of the replaced soil. At each of the sample points, assess the replaced soil to a depth 15 cm into the undisturbed subsoil. The maximum assessment depth shall be 50 cm. Note that for well-vegetated older sites, these criteria may be waived by the Conservation and Reclamation Inspector.
Vegetation must be present at assessment time	OK as is.
Length of time vegetation must have been present at time of inquiry	Generally, two (2) growing seasons without fertilizer or amendments in the Green Area. Generally, a minimum of one (1) growing season, including an over-wintering period, without fertilizer on Public Land in the White Area. For private land, the time to assessment will vary with crop/vegetation type. Since the purpose of the vegetation assessment is to ensure that there are no growth, production or rooting restrictions, the crop/vegetation must have time to explore the full reconstructed soil zone. On non-intensively managed land, the vegetation must be self-sustaining.
Vegetation - species composition	Ok. Add "... or to meet the land management objectives". This will allow you to identify a target species composition where there is no similar control (e.g., Green Area or cleared bush on private land) or a target seral stage for native areas (e.g., native prairie).
Vegetation - Vigour	Rename as Vigour/Health Identify that the characteristics we are looking for include height, colour, disease, crop quality, root quantity and quality, etc. These are meant to be indicators of stress in plants that could reflect poor reclamation.

Wellsite Reclamation Criteria Comments	
Vegetation - height and density	Delete Height. Density OK as is. Applies to all lands, but there is an exemption for areas where the adjacent vegetation is not similar (e.g., there is no control for comparison).
Vegetation - cover	OK as is. The litter contribution can not be greater than the control. Also, amendments (e.g., straw) are not included in the calculation for cover.
Vegetation - rooting	Delete. Goes in vigour and in Soil Profile Assessment.
Vegetation - bare areas	OK as is.

TOPSOIL AND SURFACE SOIL REPLACEMENT DEPTH CALCULATION

STEP 1: Calculate your average control depth (ACD) from your control depth measurements. Make sure that all topographic positions on site are represented by the control locations.

STEP 2: Calculate your average required replacement depth (ARD)

a: On private land and cultivated public land

- ARD = 0.9 X ACD for sites constructed in 1993 or later
- ARD = 0.8 X ACD for sites constructed from 1983 to 1992
- ARD = 0.7 X ACD for site constructed before 1983

b: On non-cultivated public lands

- ARD = 0.8 X ACD for sites constructed in 1993 or later
- ARD = 0.6 X ACD for sites constructed from 1983 to 1992
- Use vegetation parameters instead of soil depth for sites constructed before 1983.

STEP 3: Calculate your minimum required replacement depth (MRD)

a: On private and cultivated public land

- MRD = ARD X 0.8

b: On non-cultivated public land

- MRD = ARD X 0.8 for 80% of sample points
- MRD = ARD X 0.4 for the remaining 20% of the sample points

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Use the following table to estimate the presence of internal restrictions to water permeability, vertical root elongation and soil aeration caused by soil structure conditions, and compare with the control.

	*Process Restriction Estimate	
Profile Zone	Restrictive	Non Restrictive
1. Topsoil		
2. Topsoil/Upper Subsoil Transition		
3. Upper Subsoil		
4. Upper/Lower Subsoil Transition		
5. Lower Subsoil		

*Process Parameters (enter in table)

a. Vertical Root Elongation
b. Water Permeability
c. Soil Aeration

Some commonly observed indicators of Root, Permeability and Aeration Restrictions.

Vertical Root Elongation Restriction Indicators

- Presence of root mats and bunches
- Presence of flattened and highly branched roots
- Presence of horizontal roots
- Presence of exped roots
- Presence of soil layers and/or abrupt texture or structure transitions
- Absence of roots within or below reconstructed profile zones
- Presence of dense and massive soil structure
- Absence of roots within soil aggregates
- Presence of early maturing crop with reduced height and density
- In mixed pasture or haylands, uneven distribution of species
- Uneven crop height and density in cropland

Water Permeability Restriction Indicators

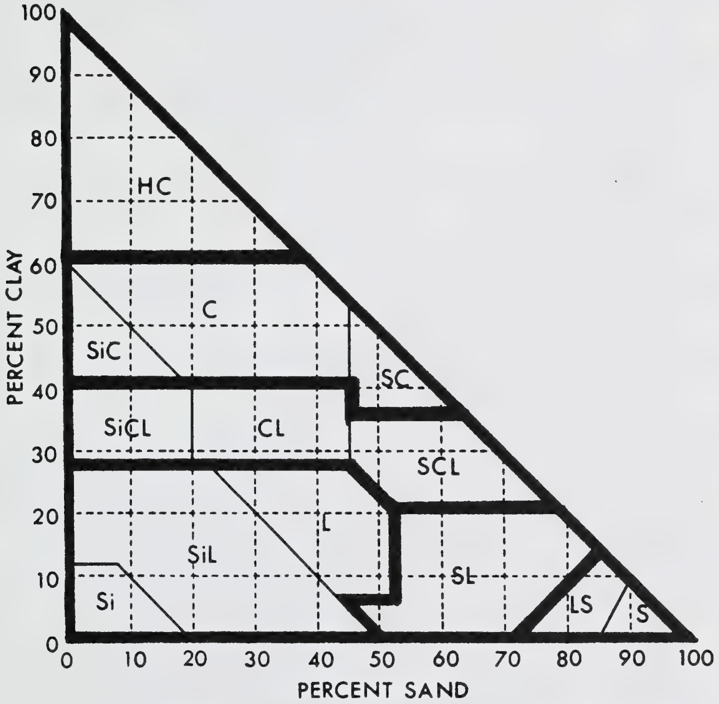
- Presence of surface ponding
- Presence of surface vehicle (equipment) ruts
- Presence of stratified or abrupt moisture changes within the soil profile
- Presence of dense, massive and/or layered structure
- Presence of flooded (yellow or stunted) crop conditions
- Presence of abrupt texture or structure transitions

Soil Aeration Restriction Indicators

- Presence of dense, massive and/or layered soil structure
- Presence of reduced pore size and pore space
- Presence of brownish-red ped surfaces
- Presence of sour odors

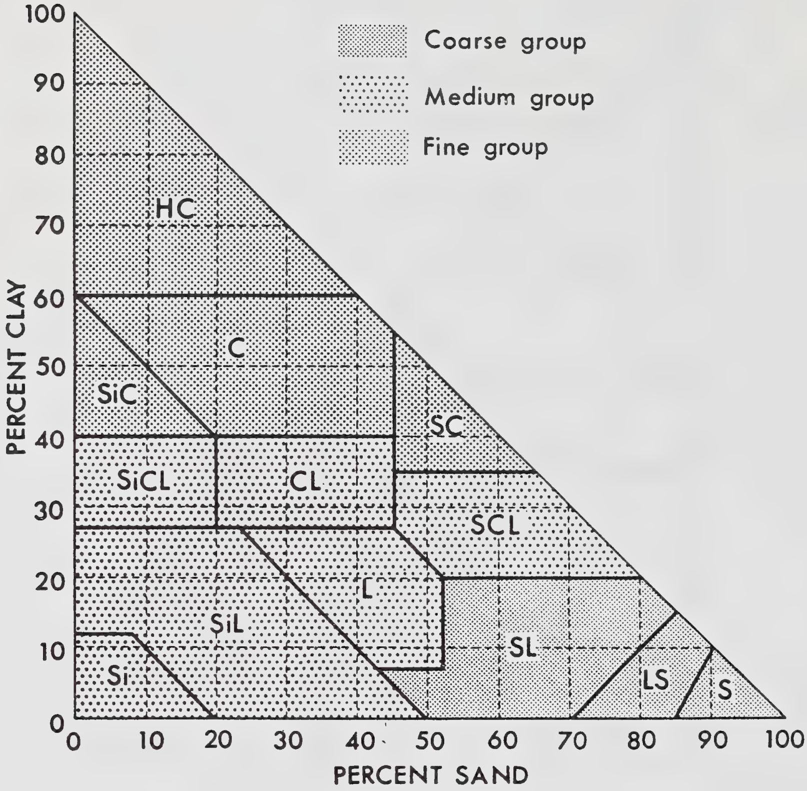
APPENDIX 'L'

CANADIAN SOIL CLASSIFICATION: COARSE, FINE AND MEDIUM TEXTURE GROUPS



Soil texture classes. Percentages of clay and sand in textural classes of soil; the remainder of each class is silt.

CANADIAN SOIL CLASSIFICATION:
COARSE, FINE AND MEDIUM TEXTURE GROUPS



The composition of family textural groups. Percentages of clay and sand in the main textural classes of soils; the remainder of each class is silt.

RECLAMATION RESEARCH REPORTS

1. **RRTAC 79-2: Proceedings: Workshop on Native Shrubs in Reclamation. P.F. Ziemkiewicz, C.A. Dermott and H.P. Sims (Editors). 104 pp. No longer available.**

The Workshop was organized as the first step in developing a Native Shrub reclamation research program. The Workshop provided a forum for the exchange of information and experiences on three topics: propagation; outplanting; and, species selection.

2. **RRTAC 80-1: Test Plot Establishment: Native Grasses for Reclamation. R.S. Sadasivaiah and J. Weijer. 19 pp. No longer available.**

The report details the species used at three test plots in Alberta's Eastern Slopes. Site preparation, experimental design, and planting method are also described.

3. **RRTAC 80-2: Alberta's Reclamation Research Program - 1979. Reclamation Research Technical Advisory Committee. 22 pp. No longer available.**

This report describes the expenditure of $1,190,006 of Alberta Heritage Savings Trust Fund monies on research under the Land Reclamation Program. The report outlines the objectives and research strategies of the four program areas, and describes the projects funded under each program.

4. **RRTAC 80-3: The Role of Organic Compounds in Salinization of Plains Coal Mining Sites. N.S.C. Cameron et al. 46 pp. No longer available.**

This is a literature review of the chemistry of sodic mine spoil and the changes expected to occur in groundwater.

5. **RRTAC 80-4: Proceedings: Workshop on Reconstruction of Forest Soils in Reclamation. P.F. Ziemkiewicz, S.K. Takyi and H.F. Regier (Editors). 160 pp. $10.00**

Experts in the field of forestry and forest soils report on research relevant to forest soil reconstruction and discuss the most effective means of restoring forestry capability of mined lands.

6. **RRTAC 80-5: Manual of Plant Species Suitability for Reclamation in Alberta. L.E. Watson, R.W. Parker and D.F. Polster. 2 vols, 541 pp. No longer available; replaced by RRTAC 89-4.**

Forty-three grass, fourteen forb, and thirty-four shrub and tree species are assessed in terms of their suitability for use in reclamation. Range maps, growth habit, propagation, tolerance, and availability information are provided.

7. **RRTAC 81-1: The Alberta Government's Reclamation Research Program - 1980. Reclamation Research Technical Advisory Committee. 25 pp. No longer available.**

This report describes the expenditure of $1,455,680 of Alberta Heritage Savings Trust Fund monies on research under the Land Reclamation Program. The report outlines the objectives and research strategies of the four program areas, and describes the projects funded under each program.

8. **RRTAC 81-2: 1980 Survey of Reclamation Activities in Alberta. D.G. Walker and R.L. Rothwell. 76 pp. $10.00**

This survey is an update of a report prepared in 1976 on reclamation activities in Alberta, and includes research and operational reclamation, locations, personnel, etc.

9. **RRTAC 81-3: Proceedings: Workshop on Coal Ash and Reclamation. P.F. Ziemkiewicz, R. Stein, R. Leitch and G. Lutwick (Editors). 253 pp. $10.00**

Presents nine technical papers on the chemical, physical, and engineering properties of Alberta fly and bottom ashes, revegetation of ash disposal sites, and use of ash as a soil amendment. Workshop discussions and summaries are also included.

10. **RRTAC 82-1: Land Surface Reclamation: An International Bibliography. H.P. Sims and C.B. Powter. 2 vols, 292 pp. $10.00**

Literature to 1980 pertinent to reclamation in Alberta is listed in Vol. 1 and is also on the University of Alberta computing system (in a SPIRES database called RECLAIM). Vol. 2 comprises the keyword index and computer access manual.

11. **RRTAC 82-2: A Bibliography of Baseline Studies in Alberta: Soils, Geology, Hydrology and Groundwater. C.B. Powter and H.P. Sims. 97 pp. $5.00**

This bibliography provides baseline information for persons involved in reclamation research or in the preparation of environmental impact assessments. Materials, up to date as of December 1981, are available in the Alberta Environment Library.

12. **RRTAC 82-3: The Alberta Government's Reclamation Research Program - 1981. Reclamation Research Technical Advisory Committee. 22 pp. No longer available.**

This report describes the expenditure of $1,499,525 of Alberta Heritage Savings Trust Fund monies on research under the Land Reclamation Program. The report outlines the objectives and research strategies of the four program areas, and describes the projects funded under each program.

13. **RRTAC 83-1: Soil Reconstruction Design for Reclamation of Oil Sand Tailings. Monenco Consultants Ltd. 185 pp. No longer available**

Volumes of peat and clay required to amend oil sand tailings were estimated based on existing literature. Separate soil prescriptions were made for spruce, jack pine, and herbaceous cover types. The estimates form the basis of field trials (See RRTAC 92-4).

14. **RRTAC 83-2: The Alberta Government's Reclamation Research Program - 1982. Reclamation Research Technical Advisory Committee. 25 pp. No longer available.**

This report describes the expenditure of $1,536,142 of Alberta Heritage Savings Trust Fund monies on research under the Land Reclamation Program. The report outlines the objectives and research strategies of the four program areas, and describes the projects funded under each program.

15. **RRTAC 83-3: Evaluation of Pipeline Reclamation Practices on Agricultural Lands in Alberta. Hardy Associates (1978) Ltd. 205 pp. No longer available.**

Available information on pipeline reclamation practices was reviewed. A field survey was then conducted to determine the effects of pipe size, age, soil type, construction method, etc. on resulting crop production.

16. **RRTAC 83-4: Proceedings: Effects of Coal Mining on Eastern Slopes Hydrology. P.F. Ziemkiewicz (Editor). 123 pp. $10.00**

Technical papers are presented dealing with the impacts of mining on mountain watersheds, their flow characteristics, and resulting water quality. Mitigative measures and priorities were also discussed.

17. **RRTAC 83-5: Woody Plant Establishment and Management for Oil Sands Mine Reclamation. Techman Engineering Ltd. 124 pp. No longer available.**

This is a review and analysis of information on planting stock quality, rearing techniques, site preparation, planting, and procedures necessary to ensure survival of trees and shrubs in oil sand reclamation.

18. **RRTAC 84-1: Land Surface Reclamation: A Review of the International Literature. H.P. Sims, C.B. Powter and J.A. Campbell. 2 vols, 1549 pp. $20.00**

Nearly all topics of interest to reclamationists including mining methods, soil amendments, revegetation, propagation and toxic materials are reviewed in light of the international literature.

19. **RRTAC 84-2: Propagation Study: Use of Trees and Shrubs for Oil Sand Reclamation. Techman Engineering Ltd. 58 pp. $10.00**

This report evaluates and summarizes all available published and unpublished information on large-scale propagation methods for shrubs and trees to be used in oil sand reclamation.

20. **RRTAC 84-3: Reclamation Research Annual Report - 1983. P.F. Ziemkiewicz. 42 pp. $5.00**

This report describes the expenditure of $1,529,483 of Alberta Heritage Savings Trust Fund monies on research under the Land Reclamation Program. The report outlines the objectives and research strategies of the four program areas and describes the projects funded under each program.

21. **RRTAC 84-4: Soil Microbiology in Land Reclamation. D. Parkinson, R.M. Danielson, C. Griffiths, S. Visser and J.C. Zak. 2 vols, 676 pp. $10.00**

This is a collection of five reports dealing with re-establishment of fungal decomposers and mycorrhizal symbionts in various amended spoil types.

22. **RRTAC 85-1: Proceedings: Revegetation Methods for Alberta's Mountains and Foothills. P.F. Ziemkiewicz (Editor). 416 pp. $10.00.**

Results of long-term experiments and field experience on species selection, fertilization, reforestation, topsoiling, shrub propagation and establishment are presented.

23. **RRTAC 85-2: Reclamation Research Annual Report - 1984. P.F. Ziemkiewicz. 29 pp. No longer available.**

This report describes the expenditure of $1,320,516 of Alberta Heritage Savings Trust Fund monies on research under the Land Reclamation Program. The report outlines the objectives and research strategies of the four program areas and describes the projects funded under each program.

24. **RRTAC 86-1: A Critical Analysis of Settling Pond Design and Alternative Technologies. A. Somani. 372 pp. $10.00**

The report examines the critical issue of settling pond design, and sizing and alternative technologies. The study was co-funded with The Coal Association of Canada.

25. **RRTAC 86-2: Characterization and Variability of Soil Reconstructed after Surface Mining in Central Alberta. T.M. Macyk. 146 pp. No longer available.**

Reconstructed soils representing different materials handling and replacement techniques were characterized, and variability in chemical and physical properties was assessed. The data obtained indicate that reconstructed soil properties are determined largely by parent material characteristics and further tempered by materials handling procedures. Mining tends to create a relatively homogeneous soil landscape in contrast to the mixture of diverse soils found before mining.

26. **RRTAC 86-3: Generalized Procedures for Assessing Post-Mining Groundwater Supply Potential in the Plains of Alberta - Plains Hydrology and Reclamation Project. M.R. Trudell and S.R. Moran. 30 pp. $5.00**

In the Plains region of Alberta, the surface mining of coal generally occurs in rural, agricultural areas in which domestic water supply requirements are met almost entirely by groundwater. Consequently, an important aspect of the capability of reclaimed lands to satisfy the needs of a residential component is the post-mining availability of groundwater. This report proposes a sequence of steps or procedures to identify and characterize potential post-mining aquifers.

27. **RRTAC 86-4: Geology of the Battle River Site: Plains Hydrology and Reclamation Project. A. Maslowski-Schutze, R. Li, M. Fenton and S.R. Moran. 86 pp. $10.00**

This report summarizes the geological setting of the Battle River study site. It is designed to provide a general understanding of geological conditions adequate to establish a framework for hydrogeological and general reclamation studies. The report is not intended to be a detailed synthesis such as would be required for mine planning purposes.

28. **RRTAC 86-5: Chemical and Mineralogical Properties of Overburden: Plains Hydrology and Reclamation Project. A. Maslowski-Schutze. 71 pp. $10.00**

This report describes the physical and mineralogical properties of overburden materials in an effort to identify individual beds within the bedrock overburden that might be significantly different in terms of reclamation potential.

29. **RRTAC 86-6: Post-Mining Groundwater Supply at the Battle River Site: Plains Hydrology and Reclamation Project. M.R. Trudell, G.J. Sterenberg and S.R. Moran. 49 pp. $5.00**

The report deals with the availability of water supply in or beneath cast overburden to support post-mining land use, including both quantity and quality considerations. The study area is in the Battle River Mining area in east-central Alberta.

30. **RRTAC 86-7: Post-Mining Groundwater Supply at the Highvale Site: Plains Hydrology and Reclamation Project. M.R. Trudell. 25 pp. $5.00**

This report evaluates the availability of water supply in or beneath cast overburden to support post-mining land use, including both quantity and quality considerations. The study area is the Highvale mining area in west-central Alberta.

31. **RRTAC 86-8: Reclamation Research Annual Report - 1985. P.F. Ziemkiewicz. 54 pp. $5.00**

This report describes the expenditure of $1,168,436 of Alberta Heritage Savings Trust Fund monies on research under the Land Reclamation Program. The report outlines the objectives and research strategies of the four program areas and describes the projects funded under each program.

32. **RRTAC 86-9: Wildlife Habitat Requirements and Reclamation Techniques for the Mountains and Foothills of Alberta. J.E. Green, R.E. Salter and D.G. Walker. 285 pp. No longer available.**

This report presents a review of relevant North American literature on wildlife habitats in mountain and foothills biomes, reclamation techniques, potential problems in wildlife habitat reclamation, and potential habitat assessment methodologies. Four biomes (Alpine, Subalpine, Montane, and Boreal Uplands) and 10 key wildlife species (snowshoe hare, beaver, muskrat, elk, moose, caribou, mountain goat, bighorn sheep, spruce grouse, and white-tailed ptarmigan) are discussed. The study was co-funded with The Coal Association of Canada.

33. **RRTAC 87-1: Disposal of Drilling Wastes. L.A. Leskiw, E. Reinl-Dwyer, T.L. Dabrowski, B.J. Rutherford and H. Hamilton. 210 pp. No longer available.**

Current drilling waste disposal practices are reviewed and criteria in Alberta guidelines are assessed. The report also identifies research needs and indicates mitigation measures. A manual provides a decision-making flowchart to assist in selecting methods of environmentally safe waste disposal.

34. **RRTAC 87-2: Minesoil and Landscape Reclamation of the Coal Mines in Alberta's Mountains and Foothills. A.W. Fedkenheuer, L.J. Knapik and D.G. Walker. 174 pp. No longer available.**

This report reviews current reclamation practices with regard to site and soil reconstruction and re-establishment of biological productivity. It also identifies research needs in the Mountain-Foothills area. The study was co-funded with The Coal Association of Canada.

35. **RRTAC 87-3: Gel and Saline Drilling Wastes in Alberta: Workshop Proceedings. D.A. Lloyd (Compiler). 218 pp. No longer available.**

Technical papers were presented which describe: mud systems used and their purpose; industrial constraints; government regulations, procedures and concerns; environmental considerations in waste disposal; and toxic constituents of drilling wastes. Answers to a questionnaire distributed to participants are included in an appendix.

36. **RRTAC 87-4: Reclamation Research Annual Report - 1986. 50 pp. No longer available.**

This report describes the expenditure of $1,186,000 of Alberta Heritage Savings Trust Fund monies on research under the Land Reclamation Program. The report outlines the objectives and research strategies of the four program areas and describes the projects funded under each program.

37. **RRTAC 87-5: Review of the Scientific Basis of Water Quality Criteria for the East Slope Foothills of Alberta. Beak Associates Consulting Ltd. 46 pp. $10.00**

The report reviews existing Alberta guidelines to assess the quality of water drained from coal mine sites in the East Slope Foothills of Alberta. World literature was reviewed within the context of the East Slopes environment and current mining operations. The ability of coal mine operators to meet the various guidelines is discussed. The study was co-funded with The Coal Association of Canada.

38. **RRTAC 87-6: Assessing Design Flows and Sediment Discharge on the Eastern Slopes. Hydrocon Engineering (Continental) Ltd. and Monenco Consultants Ltd. 97 pp. $10.00**

The report provides an evaluation of current methodologies used to determine sediment yields due to rainfall events in well-defined areas. Models are available in Alberta to evaluate water and sediment discharge in a post-mining situation. SEDIMOT II (Sedimentology Disturbed Modelling Techniques) is a single storm model that was developed specifically for the design of sediment control structures in watersheds disturbed by surface mining and is well suited to Alberta conditions. The study was co-funded with The Coal Association of Canada.

39. **RRTAC 87-7: The Use of Bottom Ash as an Amendment to Sodic Spoil. S. Fullerton. 83 pp. No longer available.**

The report details the use of bottom ash as an amendment to sodic coal mine spoil. Several rates and methods of application of bottom ash to sodic spoil were tested to determine which was the best at reducing the effects of excess sodium and promoting crop growth. Field trials were set up near the Vesta mine in East Central Alberta using ash readily available from a nearby coal-fired thermal generating station. The research indicated that bottom ash incorporated to a depth of 30 cm using a subsoiler provided the best results.

40. **RRTAC 87-8: Waste Dump Design for Erosion Control. R.G. Chopiuk and S.E. Thornton. 45 pp. $5.00**

This report describes a study to evaluate the potential influence of erosion from reclaimed waste dumps on downslope environments such as streams and rivers. Sites were selected from coal mines in Alberta's mountains and foothills, and included resloped dumps of different configurations and ages, and having different vegetation covers. The study concluded that the average annual amount of surface erosion is minimal. As expected, erosion was greatest on slopes which were newly regraded. Slopes with dense grass cover showed no signs of erosion. Generally, the amount of erosion decreased with time, as a result of initial loss of fine particles, the formation of a weathered surface, and increased vegetative cover.

41. **RRTAC 87-9: Hydrogeology and Groundwater Chemistry of the Battle River Mining Area. M.R. Trudell, R.L. Faught and S.R. Moran. 97 pp. No longer available.**

This report describes the premining geologic conditions in the Battle River coal mining area including the geology as well as the groundwater flow patterns, and the groundwater quality of a sequence of several water-bearing formations extending from the surface to a depth of about 100 metres.

42. **RRTAC 87-10: Soil Survey of the Plains Hydrology and Reclamation Project - Battle River Project Area. T.M. Macyk and A.H. MacLean. 62 pp. plus 8 maps. $10.00**

The report evaluates the capability of post-mining landscapes and assesses the changes in capability as a result of mining, in the Battle River mining area. Detailed soils information is provided in the report for lands adjacent to areas already mined as well as for lands that are destined to be mined. Characterization of the reconstructed soils in the reclaimed areas is also provided. Data were collected from 1979 to 1985. Eight maps supplement the report.

43. **RRTAC 87-11: Geology of the Highvale Study Site: Plains Hydrology and Reclamation Project. A. Maslowski-Schutze. 78 pp. $10.00**

The report is one of a series that describes the geology, soils and groundwater conditions at the Highvale Coal Mine study site. The purpose of the study was to establish a summary of site geology to a level of detail necessary to provide a framework for studies of hydrogeology and reclamation.

44. **RRTAC 87-12: Premining Groundwater Conditions at the Highvale Site. M.R. Trudell and R. Faught. 83 pp. No longer available.**

This report presents a detailed discussion of the premining flow patterns, hydraulic properties, and isotopic and hydrochemical characteristics of five layers within the Paskapoo Geological Formation, the underlying sandstone beds of the Upper Horseshoe Canyon Formation, and the surficial glacial drift.

45. **RRTAC 87-13: An Agricultural Capability Rating System for Reconstructed Soils. T.M. Macyk. 27 pp. $5.00**

This report provides the rationale and a system for assessing the agricultural capability of reconstructed soils. Data on the properties of the soils used in this report are provided in RRTAC 86-2.

46. **RRTAC 88-1: A Proposed Evaluation System for Wildlife Habitat Reclamation in the Mountains and Foothills Biomes of Alberta: Proposed Methodology and Assessment Handbook. T.R. Eccles, R.E. Salter and J.E. Green. 101 pp. plus appendix. $10.00**

The report focuses on the development of guidelines and procedures for the assessment of reclaimed wildlife habitat in the Mountains and Foothills regions of Alberta. The technical section provides background documentation including a discussion of reclamation planning, a listing of reclamation habitats and associated key wildlife species, conditions required for development, recommended revegetation species, suitable reclamation techniques, a description of the recommended assessment techniques and a glossary of basic terminology. The assessment handbook section contains basic information necessary for evaluating wildlife habitat reclamation, including assessment scoresheets for 15 different reclamation habitats, standard methodologies for measuring habitat variables used as assessment criteria, and minimum requirements for certification. This handbook is intended as a field manual that could potentially be used by site operators and reclamation officers. The study was co-funded with The Coal Association of Canada.

47. **RRTAC 88-2: Plains Hydrology and Reclamation Project: Spoil Groundwater Chemistry and its Impacts on Surface Water. M.R. Trudell (Compiler). 135 pp. No longer available.**

Two reports comprise this volume. The first "Chemistry of Groundwater in Mine Spoil, Central Alberta," describes the chemical make-up of spoil groundwater at four mines in the Plains of Alberta. It explains the nature and magnitude of changes in groundwater chemistry following mining and reclamation. The second report, "Impacts of Surface Mining on Chemical Quality of Streams in the Battle River Mining Area," describes the chemical quality of water in streams in the Battle River mining area, and the potential impact of groundwater discharge from surface mines on these streams.

48. **RRTAC 88-3: Revegetation of Oil Sands Tailings: Growth Improvement of Silver-berry and Buffalo-berry by Inoculation with Mycorrhizal Fungi and N_2-Fixing Bacteria. S. Visser and R.M. Danielson. 98 pp. $10.00**

The report provides results of a study: (1) To determine the mycorrhizal affinities of various actinorrhizal shrubs in the Fort McMurray, Alberta region; (2) To establish a basis for justifying symbiont inoculation of buffalo-berry and silver-berry; (3) To develop a growing regime for the greenhouse production of mycorrhizal, nodulated silver-berry and buffalo-berry; and, (4) To conduct a field trial on reconstructed soil on the Syncrude Canada Limited oil sands site to critically evaluate the growth performance of inoculated silver-berry and buffalo-berry as compared with their un-inoculated counterparts.

49. **RRTAC 88-4: Plains Hydrology and Reclamation Project: Investigation of the Settlement Behaviour of Mine Backfill. D.R. Pauls (compiler). 135 pp. $10.00**

This three part volume covers the laboratory assessment of the potential for subsidence in reclaimed landscapes. The first report in this volume, "Simulation of Mine Spoil Subsidence by Consolidation Tests," covers laboratory simulations of the subsidence process particularly as it is influenced by resaturation of mine spoil. The second report, "Water Sensitivity of Smectitic Overburden: Plains Region of Alberta," describes a series of laboratory tests to determine the behaviour of overburden materials when brought into contact with water. The report entitled "Classification System for Transitional Materials: Plains Region of Alberta," describes a lithological classification system developed to address the characteristics of the smectite rich, clayey transition materials that make up the overburden in the Plains of Alberta.

50. **RRTAC 88-5: Ectomycorrhizae of Jack Pine and Green Alder: Assessment of the Need for Inoculation, Development of Inoculation Techniques and Outplanting Trials on Oil Sand Tailings. R.M. Danielson and S. Visser. 177 pp. No longer available.**

The overall objective of this research was to characterize the mycorrhizal status of Jack Pine and Green Alder which are prime candidates as reclamation species for oil sand tailings and to determine the potential benefits of mycorrhizae on plant performance. This entailed determining the symbiont status of container-grown nursery stock and the quantity and quality of inoculum in reconstructed soils, developing inoculation techniques and finally, performance testing in an actual reclamation setting.

51. **RRTAC 88-6: Reclamation Research Annual Report - 1987. Reclamation Research Technical Advisory Committee. 67 pp. No longer available.**

This annual report describes the expenditure of $500,000.00 of Alberta Heritage Savings Trust Fund monies on research under the Land Reclamation Program. The report outlines the objectives and research strategies of the four program areas, and describes the projects funded under each program.

52. **RRTAC 88-7: Baseline Growth Performance Levels and Assessment Procedure for Commercial Tree Species in Alberta's Mountains and Foothills. W.R. Dempster and Associates Ltd. 66 pp. $5.00**

Data on juvenile height development of lodgepole pine and white spruce from cut-over or burned sites in the Eastern Slopes of Alberta were used to define reasonable expectations of early growth performance as a basis for evaluating the success of reforestation following coal mining. Equations were developed predicting total seedling height and current annual height increment as a function of age and elevation. Procedures are described for applying the equations, with further adjustments for drainage class and aspect, to develop local growth performance against these expectations. The study was co-funded with The Coal Association of Canada.

53. **RRTAC 88-8: Alberta Forest Service Watershed Management Field and Laboratory Methods. A.M.K. Nip and R.A. Hursey. 4 Sections, various pagings. $10.00**

Disturbances such as coal mines in the Eastern Slopes of Alberta have the potential for affecting watershed quality during and following mining. The collection of hydrometric, water quality and hydrometeorologic information is a complex task. A variety of instruments and measurement methods are required to produce a record of hydrologic inputs and outputs for a watershed basin. There is a growing awareness and recognition that standardization of data acquisition methods is required to ensure data comparability, and to allow comparison of data analyses. The purpose of this manual is to assist those involved in the field of data acquisition by outlining methods, practices and instruments which are reliable and recognized by the International Organization for Standardization.

54. **RRTAC 88-9: Computer Analysis of the Factors Influencing Groundwater Flow and Mass Transport in a System Disturbed by Strip Mining. F.W. Schwartz and A.S. Crowe. 78 pp. No longer available.**

Work presented in this report demonstrates how a groundwater flow model can be used to study a variety of mining-related problems such as declining water levels in areas around the mine as a result of dewatering, and the development of high water tables in spoil once resaturation is complete. This report investigates the role of various hydrogeological parameters that influence the magnitude, timing, and extent of water level changes during and following mining at the regional scale. The modelling approach described here represents a major advance on existing work.

55. **RRTAC 88-10: Review of Literature Related to Clay Liners for Sump Disposal of Drilling Wastes. D.R. Pauls, S.R. Moran and T. Macyk. 61 pp. No longer available.**

The report reviews and analyses the effectiveness of geological containment of drilling waste in sumps. Of particular importance was the determination of changes in properties of clay materials as a result of contact with highly saline brines containing various organic chemicals.

56. **RRTAC 88-11: Highvale Soil Reconstruction Project: Five Year Summary. D.N. Graveland, T.A. Oddie, A.E. Osborne and L.A. Panek. 104 pp. $10.00**

This report provides details of a five year study to determine a suitable thickness of subsoil to replace over minespoil in the Highvale plains coal mine area to ensure return of agricultural capability. The study also examined the effect of slope and aspect on agricultural capability. This study was funded and managed with industry assistance.

57. **RRTAC 88-12: A Review of the International Literature on Mine Spoil Subsidence. J.D. Scott, G. Zinter, D.R. Pauls and M.B. Dusseault. 36 pp. $10.00**

The report reviews available engineering literature relative to subsidence of reclaimed mine spoil. The report covers methods for site investigation, field monitoring programs and lab programs, mechanisms of settlement, and remedial measures.

58. **RRTAC 89-1: Reclamation Research Annual Report - 1988. 74 pp. $5.00**

This annual report describes the expenditure of $280,000.00 of Alberta Heritage Savings Trust Fund monies on research under the Land Reclamation Program. The report outlines the objectives and research strategies of the four program areas, and describes the projects funded under each program.

59. **RRTAC 89-2: Proceedings of the Conference: Reclamation, A Global Perspective. D.G. Walker, C.B. Powter and M.W. Pole (Compilers). 2 Vols., 854 pp. No longer available.**

Over 250 delegates from all over the world attended this conference held in Calgary in August, 1989. The proceedings contains over 85 peer-reviewed papers under the following headings: A Global Perspective; Northern and High Altitude Reclamation; Fish & Wildlife and Rangeland Reclamation; Water; Herbaceous Revegetation; Woody Plant Revegetation and Succession; Industrial and Urban Sites; Problems and Solutions; Sodic and Saline Materials; Soils and Overburden; Acid Generating Materials; and, Mine Tailings.

60. **RRTAC 89-3: Efficiency of Activated Charcoal for Inactivation of Bromacil and Tebuthiuron Residues in Soil. M.P. Sharma. 38 pp. ISBN 0-7732-0878-X. $5.00**

Bromacil and Tebuthiuron were commonly used soil sterilants on well sites, battery sites and other industrial sites in Alberta where total vegetation control was desired. Activated charcoal was found to be effective in binding the sterilants in greenhouse trials. The influence of factors such as herbicide:charcoal concentration ratio, soil texture, organic matter content, soil moisture, and the time interval between charcoal incorporation and plant establishment were evaluated in the greenhouse.

61. **RRTAC 89-4: Manual of Plant Species Suitability for Reclamation in Alberta - 2nd Edition. Hardy BBT Limited. 436 pp. ISBN 0-7732-0882-8. $10.00.**

This is an updated version of RRTAC Report 80-5 which describes the characteristics of 43 grass, 14 forb and 34 shrub and tree species which make them suitable for reclamation in Alberta. The report has been updated in several important ways: a line drawing of each species has been added; the range maps for each species have been redrawn based on an ecosystem classification of the province; new information (to 1990) has been added, particularly in the sections on reclamation use; and the material has been reorganized to facilitate information retrieval. Of greatest interest is the performance chart that precedes each species and the combined performance charts for the grass, forb, and shrub/tree groups. These allow the reader to pick out at a glance species that may suit their particular needs. The report was produced with the assistance of a grant from the Recreation, Parks and Wildlife Foundation.

62. **RRTAC 89-5: Battle River Soil Reconstruction Project Five Year Summary. L.A. Leskiw. 188 pp. No longer available.**

This report summarizes the results of a five year study to investigate methods required to return capability to land surface mined for coal in the Battle River area of central Alberta. Studies were conducted on: the amounts of subsoil required, the potential of gypsum and bottom ash to amend adverse soil properties, and the effects of slope angle and aspect. Forage and cereal crop growth was evaluated, as were changes in soil chemistry, density and moisture holding characteristics.

63. **RRTAC 89-6: Detailed Sampling, Characterization and Greenhouse Pot Trials Relative to Drilling Wastes in Alberta. T.M. Macyk, F.I. Nikiforuk, S.A. Abboud and Z.W. Widtman. 228 pp. No longer available.**

This report summarizes a three-year study of the chemistry of freshwater gel, KCl, NaCl, DAP, and invert drilling wastes, both solids and liquids, from three regions in Alberta: Cold Lake, Eastern Slopes, and Peace River/Grande Prairie. A greenhouse study also examined the effects of adding various amounts of waste to soil on grass growth and soil chemistry. Methods for sampling drilling wastes are recommended.

64. **RRTAC 89-7: A User's Guide for the Prediction of Post-Mining Groundwater Chemistry from Overburden Characteristics. M.R. Trudell and D.C. Cheel. 55 pp. $5.00**

This report provides the detailed procedure and methodology that is required to produce a prediction of post-mining groundwater chemistry for plains coal mines, based on the soluble salt characteristics of overburden materials. The fundamental component of the prediction procedure is the geochemical model PHREEQE, developed by the U.S. Geological Survey, which is in the public domain and has been adapted for use on personal computers.

65. **RRTAC 90-1: Reclamation Research Annual Report - 1989. 62 pp. No longer available.**

This annual report describes the expenditure of $480,000.00 of Alberta Heritage Savings Trust Fund monies on research under the Land Reclamation Program. The report outlines the objectives and research strategies of the four program areas, and describes the projects funded under each program.

66. **RRTAC 90-2: Initial Selection for Salt Tolerance in Rocky Mountain Accessions of Slender Wheatgrass and Alpine Bluegrass. R. Hermesh, J. Woosaree, B.A. Darroch, S.N. Acharya and A. Smreciu. 40 pp. $5.00**

Selected lines of slender wheatgrass and alpine bluegrass collected from alpine and subalpine regions of Alberta as part of another native grass project were evaluated for their ability to emerge in a saline medium. Eleven slender wheatgrass and 72 alpine bluegrass lines had a higher percentage emergence than the Orbit Tall Wheatgrass control (a commonly available commercial grass). This means that as well as an ability to grow in high elevation areas, these lines may also be suitable for use in areas where saline soil conditions are present. Thus, their usefulness for reclamation has expanded.

67. **RRTAC 90-3: Natural Plant Invasion into Reclaimed Oil Sands Mine Sites. Hardy BBT Limited. 65 pp. $5.00**

Vegetation data from reclaimed sites on the Syncrude and Suncor oil sands mines have been summarized and related to site and factors and reclamation methods. Natural invasion into sites seeded to agronomic grasses and legumes was minimal even after 15 years. Invasion was slightly greater in sites seeded to native species, but was greatest on sites that were not seeded. Invasion was mostly from agronomic species and native forbs; native shrub and tree invasion was minimal.

68. **RRTAC 90-4: Physical and Hydrological Characteristics of Ponds in Reclaimed Upland Landscape Settings and their Impact on Agricultural Capability. S.R. Moran, T.M. Macyk, M.R. Trudell and M.E. Pigot, Alberta Research Council. 76 pp. $5.00**

The report details the results and conclusions from studying a pond in a reclaimed upland site in Vesta Mine. The pond formed as a result of two factors: (1) a berm which channelled meltwater into a series of subsidence depressions, forming a closed basin; and (2) low hydraulic conductivity in the lower subsoil and upper spoil as a result of compaction during placement and grading which did not allow for rapid drainage of ponded water. Ponds such as this in the reclaimed landscape can affect agricultural capability by: (1) reducing the amount of farmable land (however, the area covered by these ponds in this region is less than half of that found in unmined areas); and, (2) creating the conditions necessary for the progressive development of saline and potentially sodic soils in the area adjacent to the pond.

69. **RRTAC 90-5: Review of the Effects of Storage on Topsoil Quality. Thurber Consultants Ltd., Land Resources Network Ltd., and Norwest Soil Research Ltd. 116 pp. $10.00**

The international literature was reviewed to determine the potential effects of storage on topsoil quality. Conclusions from the review indicated that storage does not appear to have any severe and longterm effects on topsoil quality. Chemical changes may be rectified with the use of fertilizers or manure. Physical changes appear to be potentially less serious than changes in soil quality associated with the stripping and respreading operations. Soil biotic populations appear to revert to pre-disturbance levels of activity within acceptable timeframes. Broad, shallow storage piles that are seeded to acceptable grass and legume species are recommended; agrochemical use should be carefully controlled to ensure soil biota are not destroyed.

70. **RRTAC 90-6: Proceedings of the Industry/Government Three-Lift Soils Handling Workshop. Deloitte & Touche. 168 pp. $10.00**

This report documents the results of a two-day workshop on the issue of three-lift soils handling for pipelines. The workshop was organized and funded by RRTAC, the Canadian Petroleum Association and the Independent Petroleum Association of Canada. Day one focused on presentation of government and industry views on the criteria for three-lift, the rationale and field data in support of three- and two-lift procedures, and an examination of the various soil handling methods in use. During day two, five working groups discussed four issues: alternatives to three-lift; interim criteria and suggested revisions; research needs; definitions of terms. The results of the workshop are being used by a government/industry committee to revise soils handling criteria for pipelines.

71. **RRTAC 90-7: Reclamation of Disturbed Alpine Lands: A Literature Review. Hardy BBT Limited. 209 pp. $10.00**

This review covers current information from North American sources on measures needed to reclaim alpine disturbances. The review provides information on pertinent Acts and regulations with respect to development and environmental protection of alpine areas. It also discusses: alpine environmental conditions; current disturbances to alpine areas; reclamation planning; site and surface preparation; revegetation; and, fertilization. The report also provides a list of research and information needs for alpine reclamation in Alberta.

72. **RRTAC 90-8: Plains Hydrology and Reclamation Project: Summary Report. S.R. Moran, M.R. Trudell, T.M. Macyk and D.B. Cheel. 105 pp. $10.00**

This report summarizes a 10-year study on the interactions of groundwater, soils and geology as they affect successful reclamation of surface coal mines in the plains of Alberta. The report covers: Characterization of the Battle River and Wabamun study areas; Properties of reclaimed materials and landscapes; Impacts of mining and reclamation on post-mining land use; and, Implications for reclamation practice and regulation. This project has led to the publication of 18 RRTAC reports and 22 papers in conference proceedings and referred journals.

73. **RRTAC 90-9: Literature Review on the Disposal of Drilling Waste Solids. Monenco Consultants Limited. 83 pp. $5.00**

This report reviews the literature on, and government and industry experience with, burial of drilling waste solids in an Alberta context. The review covers current regulations in Alberta, other provinces, various states in the US and other countries. Definitions of various types of burial are provided, as well as brief summaries of other possible disposal methods. Environmental concerns with the various options are presented as well as limited information on costs and monitoring of burial sites. The main conclusion of the work is that burial is still a viable option for some waste types but that each site and waste type must be evaluated on its own merits.

74. **RRTAC 90-10: Potential Contamination of Shallow Aquifers by Surface Mining of Coal. M.R. Trudell, S.R. Moran and T.M. Macyk. 75 pp. $5.00**

This report presents the results of a field investigation of the movement of salinized groundwater from a mined and reclaimed coal mine near Forestburg into an adjacent unmined area. The movement is considered to be an unusual occurrence resulting from a combination of a hydraulic head that is higher in the mined area than in the adjacent coal aquifer, and the presence of a thin surficial sand aquifer adjacent to the mine. The high hydraulic head results from deep ponds in the reclaimed landscape that recharge the base of the spoil.

75. **RRTAC 91-1: Reclamation Research Annual Report - 1990. Reclamation Research Technical Advisory Committee. 69 pp. No longer available.**

This annual report describes the expenditure of $499 612 of Alberta Heritage Savings Trust Fund monies on research under the Land Reclamation Program. The report outlines the objectives and research strategies of the four program areas, and describes the projects funded under each program. The report lists the 70 research reports published under the program.

76. **RRTAC 91-2: Winter Soil Evaluation and Mapping for Regulated Pipelines. A.G. Twardy. 43 pp. ISBN 0-7732-0874-7. $5.00**

Where possible, summer soil evaluations are preferred for pipelines. However, when winter soil evaluations must be done, this report lays out the constraints and requirements for obtaining the best possible information. Specific recommendations include: restricting evaluations to the time of day with the best light conditions; use of core- or auger-equipped drill-trucks; increased frequency of site inspections and soil analyses; and, hiring a well-qualified pedologist. The province's soils are divided into four classes, based on their difficulty of evaluation in winter: slight (most soils); moderate; high; and, severe (salt-affected soils in the Brown and Dark Brown Soil Zones).

77. **RRTAC 91-3: A User Guide to Pit and Quarry Reclamation in Alberta. J.E. Green, T.D. Van Egmond, C. Wylie, I. Jones, L. Knapik and L.R. Paterson. 151 pp. ISBN 0-7732-0876-3. $10.00**

Sand and gravel pits or quarries are usually reclaimed to the original land use, especially if that was better quality agricultural or forested land. However, there are times when alternative land uses are possible. This report outlines some of the alternate land uses for reclaimed sand and gravel pits or quarries, including: agriculture, forestry, wildlife habitat, fish habitat, recreation, and residential and industrial use. The report provides a general introduction to the industry and to the reclamation process, and then outlines some of the factors to consider in selecting a land use and the methods for reclamation. The report is not a detailed guide to reclamation; it is intended to help an operator determine if a land use would be suitable and to guide him or her to other sources of information.

78. **RRTAC 91-4: Soil Physical Properties in Reclamation. M.A. Naeth, D.J. White, D.S. Chanasyk, T.M. Macyk, C.B. Powter and D.J. Thacker. 204 pp. ISBN 0-7732-0880-1. $10.00**

This report provides information from the literature and Alberta sources on a variety of soil physical properties that can be measured on reclaimed sites. Each property is explained, measurement methods, problems, level of accuracy and common soil values are presented, and methods of dealing with the property (prevention, alleviation) are discussed. The report also contains the results of a workshop held to discuss soil physical properties and the state-of-the-art in Alberta.

79. **RRTAC 92-1: Reclamation of Sterilant Affected Sites: A Review of the Issue in Alberta. M. Cotton and M.P. Sharma. 64 pp. ISBN 0-7732-0884-4. No longer available**

This report assesses the extent of sterilant use on oil and gas leases in Alberta, identifies some of the concerns related to reclamation of sterilant affected sites and the common methods for reclaiming these sites, and outlines the methods for sampling and analyzing soils from sterilant affected sites. The report also provides an outline of a research program to address issues raised by government and industry staff.

80. **RRTAC 92-2: Reclamation Research Annual Report - 1991. Reclamation Research Technical Advisory Committee. 55 pp. ISBN 0-7732-0888-7. No longer available.**

This report describes the expenditure of $485,065 of Alberta Heritage Savings Trust Fund monies on research under the Land Reclamation Program. The report outlines the objectives and research strategies of the five program areas, and describes the projects funded under each program. It also lists the 75 research reports that have been published to date.

81. **RRTAC 92-3: Proceedings of the Industry/Government Pipeline Reclamation Success Measurement Workshop. R.J. Mahnic and J.A. Toogood. 62 pp. ISBN 0-7732-0886-0. $5.00.**

This report presents the results of a workshop to identify the soil and vegetation parameters that should be used to assess reclamation success on pipelines in Alberta. Six soil parameters (topsoil admixing; topsoil replacement thickness; compaction; soil loss by erosion; texture; and salinity) and six vegetation parameters (plant density; species composition; ground cover; vigour; weeds/undesirable species; and rooting characteristics) were selected as most important. Working groups discussed these parameters and presented suggested methods for assessing them in the field.

82. **RRTAC 92-4: Oil Sands Soil Reconstruction Project Five Year Summary. HBT AGRA Limited. 109 pp. ISBN 0-7732-0875-5. $10.00**

This report documents a five year study of the effects of clay and peat amendments to oil sand tailings sand on survival and growth of trees and shrubs. Ten species (jack pine, white spruce, serviceberry, silverberry, buffaloberry, pin cherry, prickly/woods rose, Northwest poplar, green alder, and Bebb willow) were planted into tailings sand amended with three levels of peat and three levels of clay. The treatments were incorporated to a depth of 20 cm or 40 cm. Data are provided on plant survival and growth, root size and distribution, disease and small mammal damage, herbaceous cover, soil moisture, soil chemistry, and bulk density.

83. **RRTAC 92-5: A Computer Program to Simulate Groundwater Flow and Contaminant Transport in the Vicinity of Active and Reclaimed Strip Mines: A User's Guide. A.S. Crowe and F.W. Schwartz, SIMCO Groundwater Research Ltd. 104 pp. plus appendix. ISBN 0-7732-0877-1. NOTE: This report is only available from the Alberta Research Council, Publications Centre, 250 Karl Clark Road, P.O. Box 8330, Station F, EDMONTON, Alberta T6H 5R7 as ARC Information Series 119. The cost is $20.00 and the cheque must be made out to the Alberta Research Council.**

The manual describes a computer program that was developed to study the influence of coal strip mining on groundwater flow systems and to simulate the transport of generated contaminants, both spatially and in time, in the vicinity of a mine. All three phases of a strip mine can be simulated: the pre-mining regional groundwater flow system; the mining and reclamation phase; and, the post-mining water level readjustment phase. The model is sufficiently general to enable the user to specify virtually any type of geological conditions, mining scenario, and boundary conditions.

84. **RRTAC 92-6: Alberta Drilling Waste Sump Chemistry Study. Volume I: Report (Volume II: Appendices is only available through the Alberta Research Council, Publications Centre, 250 Karl Clark Road, P.O. Box 8330, Station F, EDMONTON, Alberta T6H 5R7. The cost is $15.00 and the cheque must be made out to the Alberta Research Council.). T.M. Macyk, S.A. Abboud and F.I. Nikiforuk, Alberta Research Council. 217 pp. ISBN 0-7732-0879-8. $10.00.**

This study synthesizes the data from sampling and analysis of the solids and liquids found in 128 drilling waste sumps across Alberta. Drilling waste types sampled included: 72 freshwater gel, 19 invert, 27 KCl, 2 NaCl, and 8 others. Data and statistics are tabulated by waste type, depth of the drill hole, and ERCB administrative region for both the solids and the liquids. Using preliminary loading limits developed by the government/industry Drilling Waste Review Committee, the report presents information on the volume and depth of waste that could be landspread, and the area required for landspreading. The oil and gas industry provided approximately $585,000 for the sampling and analysis phase of this study.

85. **RRTAC 93-1: Reclamation of Native Grasslands in Alberta: A Review of the Literature. D.S. Kerr, L.J. Morrison and K.E. Wilkinson, Environmental Management Associates. 205 pp. plus appendices. ISBN 0-7732-0881-X. $10.00.**

A review of the literature on native grassland reclamation was conducted to summarize the current state of knowledge on reclamation and restoration efforts within Alberta. The review is comprehensive, including an overview of the regulations and guidelines governing land use on native prairie; a description of the dominant grassland ecoregions in Alberta; a review of the common disturbance types, extent and biophysical effects of disturbance on native prairie within Alberta; a description of the factors which influence the degree of disturbance and reclamation; and examples of both natural and enhanced recovery of disturbed sites through the examination of selected case studies.

86. **RRTAC 93-2: Reclamation Research Annual Report - 1992. Reclamation Research Technical Advisory Committee. 56 pp. ISBN 0-7732-0883-6. $5.00.**

This report describes the expenditure of $474,705 of Alberta Heritage Savings Trust Fund monies on research under the Land Reclamation Program. The report outlines the objectives and the research strategies of the five programs, and describes the projects funded under each program. It also lists the 85 research reports that have been published to date.

87. **RRTAC 93-3: Catalogue of Technologies for Reducing the Environmental Impact of Fine Tailings from Oil Sand Processing. B.J. Fuhr, Alberta Research Council, D.E. Rose, Dereng Enterprises Ltd., and D. Taplin, Komex International Ltd. 63 pp. ISBN 0-7732-0885-2. $5.00.**

A catalogue containing 22 technologies for reducing the environmental impact of fine tailings derived from oil sands has been assembled. The report consists of an introduction to oil sand processing and fine tailings generation, a simple spreadsheet for comparing the technologies, and a process summary for each technology. The technologies were not evaluated for effectiveness. Rather, a detailed set of questions was prepared that highlights the environmentally-related information a proponent should have. These questions will help to form a basis for comparisons among the technologies.

88. **RRTAC 93-4: Organic Materials as Soil Amendments in Reclamation: A Review of the Literature. Land Resources Network Ltd. 228 pp. ISBN 0-7732-0887-9. $10.00**

A review of the literature was conducted to examine the effect of various organic materials when used as amendments to disturbed soil. Organic amendments reviewed included animal manures, crop residues, peat, wood wastes, sewage sludge, municipal yard waste, humates, vermicomposts, and spent mushroom composts. Their effects on soil chemistry, physical properties, and biology were examined. Application methods, costs, longevity of effects, and use in reclamation were also reviewed. Benefits and drawbacks of each were discussed.

89. **RRTAC 93-5: Drilling Waste Disposal. T.M. Macyk and S.A. Abboud, Alberta Research Council. 125 pp. ISBN 0-7732-0889-5. $10.00**

An overall perspective and description of the steps involved in the management and land-based disposal of drilling wastes in Alberta. A computer program, available from the Alberta Research Council, has been written to support the data management required for proper disposal. A field manual is in preparation. These three information sources provide technical support for the Energy Resources Conservation Board's Guide G-50: Drilling Waste Management.

90. **RRTAC 93-6: Mapping and Characterization of Cutover Peatlands for Reclamation Planning. L.W. Turchenek, Alberta Research Council, W.S. Tedder, Alberta Agriculture, Food and Rural Development, and R. Krzanowski, Alberta Research Council. 100 pp. ISBN 0-7732-6038-2. $5.00**

The report presents a methodology for cost-effective soil survey and sampling of cutover peatlands. It also presents baseline chemical information and data interpretation for peat materials from a cutover peatland site. The report provides background information on classifying and describing peatlands. This information can be used to develop reclamation plans.

91. **RRTAC 93-7: Soil Series Information for Reclamation Planning in Alberta. Pedocan Land Evaluation Ltd. Various pagings. ISBN 0-7732-6041-2. $10.00**

This manual has been published to provide conservation and reclamation planners with information and guidelines to help understand and use soil inventory data. The soil series in the manual correspond to those in the Generation 2 Alberta Soil Names File. Part 1 of the manual describes the terminology used in soil surveys and presents the assumptions and conventions upon which the interpretations for each soil series are based. Part 2 presents typical data and interpretations for each soil series.

92. **RRTAC 93-8: Oils Sands Sludge Dewatering by Freeze-Thaw and Evapotranspiration. R. L. Johnson, P. Bork. W. H. James and L. Koverny, Alberta Environmental Centre. 247 pp. ISBN 0-7732-6042-0. $10.00**

This report presents data from a series of laboratory and field experiments designed to evaluate the removal of water from oil sands sludge. A number of plant species were evaluated and two, reed canary grass and western dock, were found to remove a significant amount of water through evapotranspiration. Freeze-thaw cycles were also found to remove water from both sand-sludge mixtures and pure sludge. A combination of freeze-thaw and biological dewatering using plants was found to increase solids content from 30% to 80%. At 80% solids the sludge had a shear strength of 120 kPa and could support machine traffic. These studies prompted further field work.

93. **RRTAC 93-9: Native Legumes for Reclamation in Alberta. A. Smreciu, Wild Rose Consulting Inc. 94 pp. ISBN 0-7732-0643-9. $5.00**

Seeds from *Astragalus* (milkvetches), *Hedysarum* (sweetbrooms), *Lupinus* (lupins), and *Oxytropis* (locoweeds) were collected from the mountains and foothills region of Alberta, from Waterton Lakes National Park to Grande Cache. The species were tested for germination and seedlings were established and evaluated for three growing seasons in Vegreville. The species were evaluated based on survival, growth and development, and yield. *Astragalus alpinus* was selected as the most promising species. *Oxytropis monticola* and *Oxytropis splendens* were also recommended.

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